AUG 28 1922

Electrical World

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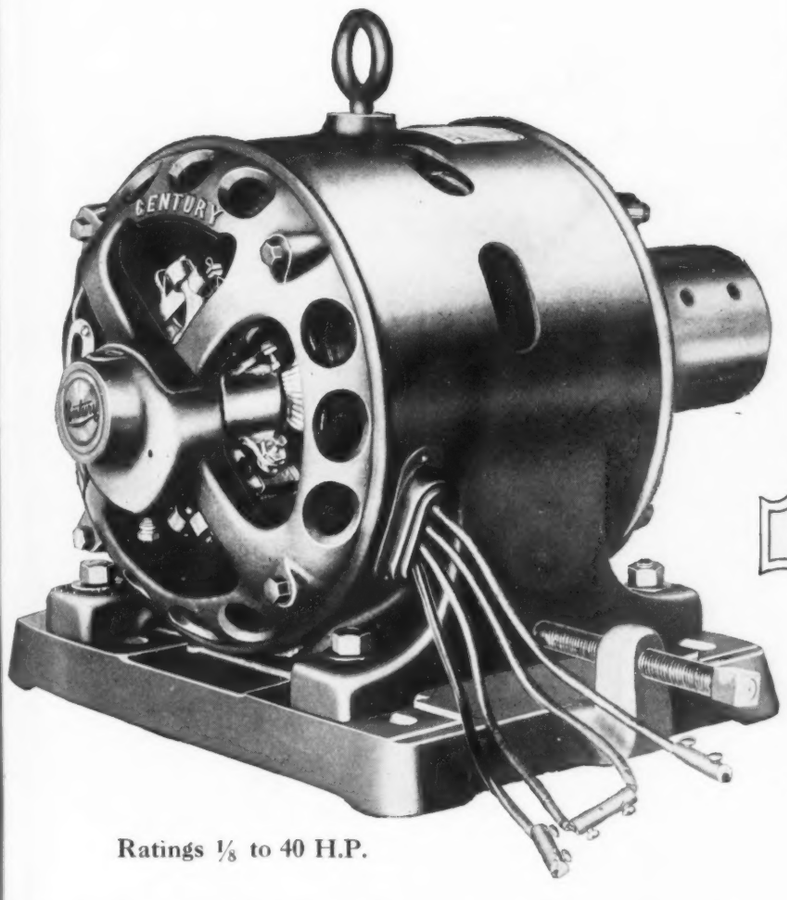

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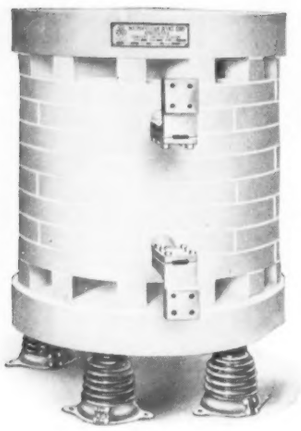

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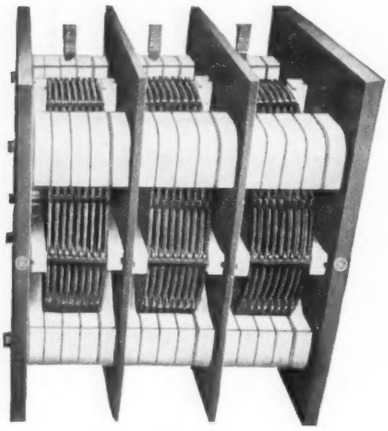

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Cataluna Power Co.	Barcelona, Spain
Chicago, Lake Shore & South Bend R. R.	Michigan City, Ind.
Cohoes Light & Power Corp.	Cohoes, N. Y.
Commonwealth Edison Co.	Chicago, Ill.
Consolidated Gas & Electric Co.	Baltimore, Md.
Dayton Power & Light Co.	Dayton, Ohio
East Hampton Gas Co.	East Hampton, Mass.
Edison Electric Illuminating Co.	Brooklyn, N. Y.
Edison Illuminating Co.	Detroit, Mich.
El Paso Power & Railroad Co.	El Paso, Texas
French General Electric Co.	Paris, France
Hydro Electric Power Commission	Toronto, Ontario
Interborough Rapid Transit Co.	New York, N. Y.
Joyce Gridland Railroad Co.	London, England
Municipal Gas & Electric Co.	Albany, N. Y.
New York Edison Company	New York, N. Y.
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N. Y. & Queens Elec. Light & Power Co.	Long Island City, N. Y.
Potomac Electric Co.	Washington, D. C.
Public Works Department	Lake Cooleridge, New Zealand
Public Service Electric Co.	Newark, N. J.
Shawinigan Hydro Elec. Power Co.	Shawinigan Falls, Ont.
Tennessee Power Co.	Chattanooga, Tenn.
Toledo R. R. & Light Co.	Toledo, Ohio
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Electrical World

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Volume 80 — New York, Saturday, August 26, 1922 — *Number* 9

Too Much Tax Exemption

"A BETTER day is in store for the world," prophesied Chief Justice William Howard Taft at one of the sessions of the American Bar Association meeting recently held in San Francisco. Much of the time of this association was taken up in providing the machinery to promote the unification of law in the commonwealths of the nation and to make the laws on the statute books more easily accessible. Great concern was expressed over the increasing cost of government.

It is quite evident, however, that if the "better day" foreseen by Mr. Taft is to become a reality, the lessening of the tax burden must bulk more largely in the purposes of legislative bodies and in the daily thought of citizens. Something more than concern is needed. Action is the demand of the hour.

THE portion of the tax burden imposed on the few is increasing by leaps and bounds, while the tax-exempt class grows. It is estimated that there are approximately thirty billion dollars' worth of tax-exempt or semi-tax-exempt public improvement or government bonds outstanding. This means that the income derived from such securities escapes the burden of taxation, and that taxable industry and property must make up the deficit.

Figuring that the thirty billion dollars is yielding the holders of the bonds a return of 4 per cent, the government is losing the tax on income that it should receive from the greater part of the $1,200,000,000 these bonds return the holders annually in interest. Industrial or agricultural undertakings which produced $1,200,000,000 annually would be paying a large part of this return to city, county, state or federal government through taxes of various forms.

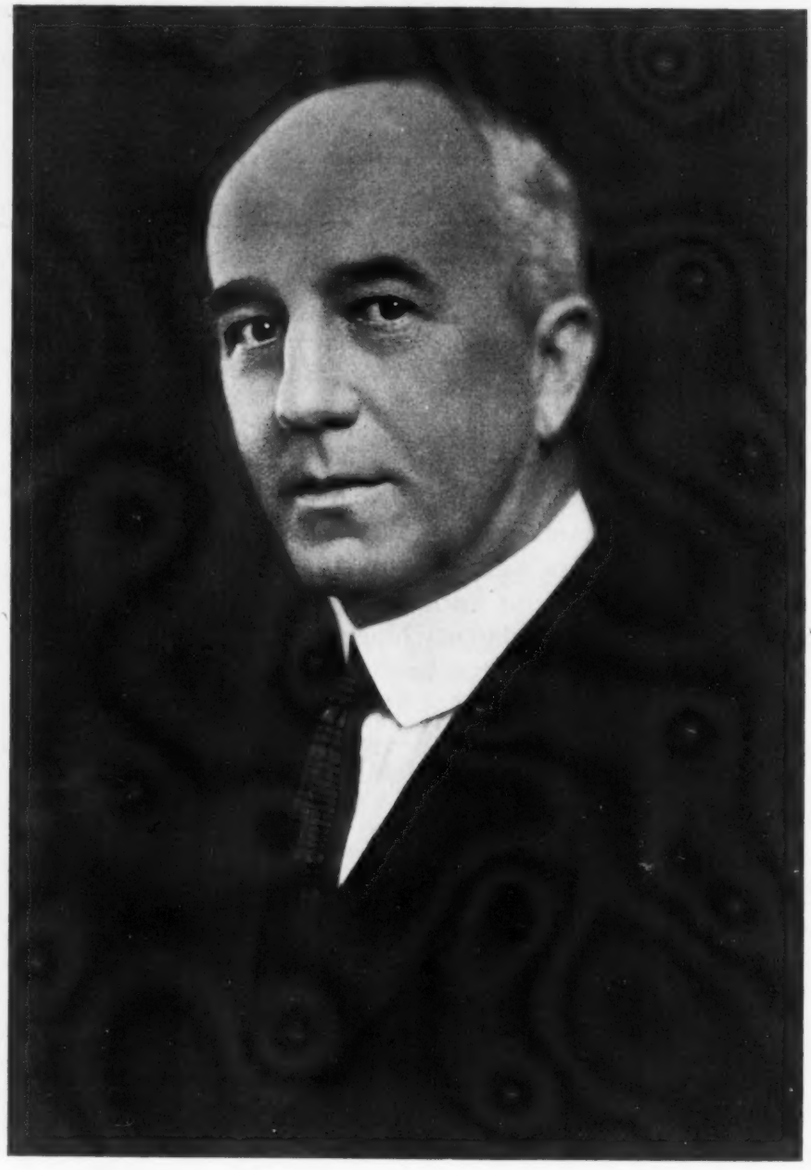
Nor has the movement toward tax-exempt securities yet been abated. Consider the case of California, where the so-called California water and power act to be voted upon by the citizens at the elections in November proposes to add $500,000,000 more to the already huge total of tax-free bonds and tax-free property in the state. Should this bill carry, California will have an indebtedness equal to 43 per cent of the combined indebtedness of all the states of the Union. It is already losing approximately $20,000,000 per annum in taxes because of tax-exempt federal, state and local bonds.

All attempts to prohibit the issuance of tax-exempt securities have so far failed. Our present system admittedly discriminates between taxpayers, impedes private financing and discourages investment in new enterprises. Unchecked, it may lead to social unrest.

HERE is something worthy of the thoughtful consideration of every citizen of the nation. At the present time 90 per cent of the taxable property carries the burden of government. Where is this going to end? Shall we wait until the percentage is seventy, sixty, forty, or until the last lone farm carries the entire load?

Preston S. Arkwright

An energetic utility executive, famous for his ability to establish good public relations.



IT IS of interest to contrast the good relations existing between capital, labor and the public in the central-station industry with different conditions in other industrial fields. For many years no better co-operation has existed between conflicting elements anywhere than is found in the electric light and power business. In this industry both the employers and the employees found the real meaning of the word service years ago, and strikes in a central-station organization are as extinct as the dodo. Central-station executives have learned that their organizations are composed of human beings, and the employees have learned that their duty is to serve other human beings.

No one has had a greater influence in establishing ideals of service than Preston S. Arkwright, president of the Georgia Railway & Power Company. His brilliant legal attainments and his sound executive abilities enabled him to take a disorganized and troubled utility situation in Atlanta and change it into one that is now in many respects a model for other localities.

In a very few years he mastered the utility business and built up a consolidated and co-ordinated system in Atlanta that stands for service, efficiency and financial integrity. On this work his ability to make and win the friendship and support of his associates was a decided asset.

Through straightforward dealings with the employees and the public Mr. Arkwright made his company famed for the civility and kindness of the employees and for its conception of service to its customers. He was born in the city of Savannah, Ga., Feb. 24, 1871. He moved to Atlanta immediately after his graduation from the University of Georgia in 1891 and, without powerful connections or the advantage of financial strength, found himself president of the biggest public utility corporation in the Southeast in little more than ten years.

When he became president of the Georgia Railway & Power Company in 1912 hydro-electric power development was practically unknown in the South. As president he has seen the company acquire the Bull Sluice development and plunge into the wilderness of north Georgia to harness the waters of the Tallulah and Tugalo Rivers, one of the biggest hydro-electric projects undertaken in the southern part of this country.

Mr. Arkwright's time has been thoroughly taken up in the past twenty years. He is now a member of the executive committees of both the National Electric Light Association and the American Electric Railway Association. He has been vice-president of the Southern Banking & Trust Company, vice-president of the Title Guarantee & Trust Company, vice-president of the Union Pinopolis Sawmills and vice-president of the Aripeka Sawmills.

In all Mr. Arkwright's association with big business he has never lost sight of the viewpoint of the other fellow, gained while he was fighting for the ground he now holds. A few months ago the Atlanta Federation of Trades adopted resolutions commending his broad-gaged attitude toward organized labor, and when the Amalgamated Association of Street and Electric Railway Employees of America met in Atlanta last year he received the signal honor of being the only employing executive ever invited to address that body. He is a member of several clubs and a frequent and popular speaker at Rotary Club activities throughout the country.

Editorial Comment

Electrical World, August 26, 1922

Volume 80 Number 9

Electric Utilities Over the Hump

IT IS very gratifying to observe the splendid operating and financial conditions in the electric light and power industry. Very largely this situation has arisen through recognition by the utilities that the public is entitled to know the facts in the industry. The public has real information and acts with confidence in dealing with the light and power companies.

This condition was brought about by hard work and co-operative effort on the part of utility managers and commissions. The embryo and incompetent regulatory bodies are gone just as the wildcat stock promoter has gone, and today good public and governmental relations are recognized assets in the utility business. Economic waste is less in the light and power business than in any other industry because financial, labor and operating conditions have been worked out on a basis of fact and because the public and the operator have been educated to appreciate the value of mutual confidence.

More than a quarter of all corporate securities issued in this country during the year have been those of electric public utilities—a total in excess of $400,000,000. Despite unsettled labor conditions and stagnant industries, the production of electric power has not varied in amount by more than 6 per cent since 1918, and the investors of the country have responded to this stabilized condition of the industry. New capital for electric utilities has been obtained at a rate which gives an average yield of above 6 per cent for long-term bonds and about a 7 per cent yield for short-term bonds.

Now is the time to secure new capital, to expand the light and power industry and to build for the future. The farms, the unwired houses and the many appliances are ready for electrical energy. The industrial depression is about over, and every electrical utility should now anticipate and prepare for its future load, so building its business that it will not be dependent on any one class for its profit.

"An Engineer's Civilization and a Lawyer's Government"

THIS apt characterization of the way in which our national government has frequently failed to respond to the genius of the American people fell recently from the lips of Edwin Ludlow, retiring president of the American Institute of Mining and Metallurgical Engineers. If, like most pithy sayings, it cannot be taken with absolute literalness—indeed, Mr. Ludlow's expansion of his thesis showed that he did not intend it to be so taken—yet it contains no small degree of truth. Engineering is dynamic; the law is static. Engineering is in haste to get on the job; the law's delay was ancient in the time of Hamlet. Engineering is for tearing down obstacles; the law is prone to erect them. Engineering tunnels the mountain; the law follows a tortuous path around its base. Engineering is mathematical and is founded on the exact symbols of arithmetic; the law is literary and dwells fondly on commas and diacritical marks.

This is a government of laws and not of men, as we are frequently reminded. The law is and must always be supreme. Lawyers, however, are men, and to their hairsplittings and professional hesitations an undue amount of political reverence has sometimes been accorded. Perhaps engineers, as their influence in government increases, will, with their shorter-cut methods, their more practical outlook, their bolder attack and their greater concern for general interests when these clash with particular ones, make the science of government express more fully the national delight in accomplishment as contrasted with debate than the preponderance of legal minds in Congress and Cabinet has made possible in the past.

Value of Conference in Revising Engineering Education

EDUCATION for the profession of engineering is a topic of unfailing interest to both educators and practical engineers. This is probably due to the difficulty of testing in application new methods for differences in points of view. The results of any new plan can only be observed over a period of years, during which conditions may change, and they are especially subject to error due to the wide difference in the natural characteristics and earlier preparation of the student body. Variations in the quality of raw material will affect the product of any process, and these variations are so wide in the case of the material coming to engineering schools as seriously to mask the probable value of any modification of method which may be introduced. Discussions on this topic are of particular value when engineers and educators meet. They have not always agreed. Not so very long ago a well-known industrial manufacturer seriously and publicly announced that for the needs of industry, as he saw them, he preferred a young man without, rather than with, technical collegiate training. Happily this extreme attitude is apparently limited to this solitary case.

There are now many evidences of the desire on the part of both industry and education to come together for discussion as to how they can mutually help each other for the betterment of the product of our engineering schools. Particularly interesting from this point of view was the meeting at the recent convention of the American Institute of Electrical Engineers devoted to engineering education. While the several papers prepared with obvious care by engineers were not without their radical suggestions, they were nevertheless offered with such obvious intent of helpful comment and were answered by the educators in such a temperate vein in discussing their value and practicability as to

set at once a new standard of mutual understanding. Present opinion seems to agree that formal engineering training should be directed away from, rather than toward, those aims of early engineering educators to bring the student into intimate contact with the materials and machinery of the profession. These methods are better left to purely vocational schools. Premium is now put on the development of qualities of character, such as clear thinking, persistence, observation, etc., and on instruction in the subjects making up a general education, confining instruction in technical subjects to the later years, and insisting on principles rather than the enumeration of various applications. It is recognized also that probably the most important factors bearing on the quality of the product of our engineering schools are the character of the raw material entering and the personal teaching ability of the instructors. The opportunities offered by improvement in either of these particulars are far greater than those pertaining to the introduction of this or that new subject.

Dubious Factors in Illumination

WE SINCERELY wish that the Illuminating Engineering Society would take up through some of its committees the still mooted point of the relation of color to effective illumination. Somehow or other it seems almost impossible to have a real investigation of this matter unmixed with irrelevant psychological and physiological data from which it is difficult to separate the facts. For instance, there are available for purposes of illumination lights of different color, ranging, let us say, all the way from the neon tube at one end of the spectrum to north skylight, so called, at the other, together with mixtures of all the intervening colors in various proportions. Now, the unfortunate fact is that up to the present we do not know definitely whether light of one color or that blended of several, including perhaps all, is really the more desirable for practical purposes. This difficulty exists because most of those who undertake so-called practical investigations in matters of this kind have not had sufficiently wide experience and lack the broad knowledge necessary to determine the facts. In particular, there has been a constant mixing up of physical with physiological and psychological conditions which renders the results extremely uncertain.

For illustration, perhaps no experiments have been more striking than those correlating speed of perception with illumination. Yet the data on speed perception are actually very closely connected with the fatigue effects on the ocular muscles, which in turn depend on the kind and rate of movement implied in the hasty observations. Color effects observed under such circumstances would in all probability bear no simple relation to static acuity tests or to the still more uncertain reaction time tests, which hopelessly mix up two probably quite independent variables. It is not even quite clear yet whether daylight in the raw, so to speak, is preferable to more nearly monochromatic illumination either from specialized sources or obtained by screening out some of the colors of daylight. All these things are of considerable practical importance in illumination and ought to be determined with something like final precision. The job is distinctly one for collaboration of the physicist, the psychologist and the ophthalmologist, a combination hardly to be expected in any one individual, but entirely feasible in a committee of a body enrolling a diversity of experts. Many another topic in illumination can be advantageously handled in such a way, but we know of none which needs at the present time more concentrated effort.

The Electrification of Soviet Russia

SURPRISING testimony as to the value of electricity to civilization is borne by Nicholas Lenin. At the last All-Russian Congress of Soviets he referred most glowingly to the electrification of Russia and reduced the complexity of Communism to the following simple formula: Soviet power + electricity = Communism. Lenin visualizes imperative and immediate work of tremendous scope and importance through the agency of electricity, which he proposes to employ for the economic construction and enrichment of Soviet Russia. For the purpose in hand the whole of Russia will be supplied with energy from superpower stations. Her naphtha, coal and peat will be utilized in this way for the production of electricity, and the country's water powers will be developed for the same purpose. A complete scheme for the electrification of the nation, her railways, farms and industries, has been prepared by an engineer named Krzyzanowski. Whatever else people may think of Lenin and his doctrines, it is evident that his scheme for the electrification of Russia is sane and far-reaching in its effect. It may fail utterly for a thousand and one reasons, or it may be brought to function. Good and lasting things grew out of the destruction wrought by the French Revolution, and who knows but that an electrified Russia may arise in the future due in part to the visions of the Moscow dictator?

Concerning a Station of Mystery

DURING the world war we heard much of the British "mystery ships," so thoroughly veiled in secrecy and mendacity that not even the most industrious Teuton spy could find out what they were and what might be their intended use. Just now, too, we hear of a mystery airship which may, if something does not happen to the engines, cross the Atlantic with a considerable passenger list in twenty-four hours—more or less—or some other comparatively brief period. In default of the necessities of war, secrecy must here be charged up to possible elements in construction for which patents have not yet been granted. However this may be, an electric station for public service already in operation would hardly seem to be a natural or proper subject of concealment, and we have been rather surprised to note the difficulties that several well-known engineers have experienced in trying to get a look at the North Tees development of the Newcastle-on-Tyne Electric Supply Company. Their difficulties, in fact, have extended to complete failure in the attempt to get permission for even a cursory inspection of these particular works, engineered, by the way, by one of the most distinguished English firms.

In the absence of a knowledge of all the circumstances severe judgment on the owners or engineers is uncalled for, especially as few Americans who have not been instructed in the conservative British methods of doing business instinctively adopt the strategic line of approach. Here, if one wishes to visit a power sta-

tion and is a person of standing in the profession whose motives are not suspected, he can usually walk straight up to the permit-issuing authority and in a few minutes obtain the necessary pass. This is not exactly the English way of doing business of any kind. The Englishman's office is his castle, defended by moat, portcullis, drawbridge and divers outworks to prevent the too sudden access of persons to him comparatively unknown on business which has not been been previously explained. Consequently one cannot often catch him offhand. If, however, the intending visitor drops a polite line several days in advance, asking for an appointment at earliest convenience, he is very likely to receive a prompt reply and to get a particularly courteous and friendly reception.

Whether the American engineers who tried to see the North Tees station thus approached it by regular siege, so to speak, we do not know. They certainly would have failed in carrying the works by assault. Further, the English are a conservative folk who would consider warily the granting of permissions which would here be a matter of course, and particularly no subordinate official of an English concern would be likely to transgress a hair's breadth beyond the letter of his instructions regarding such matters.

There must be some specific reason for the secretiveness of the owners of this particular station, a reason which probably has nothing to do with the nationality of those who might wish to see it. Now and then, if things are not going in quite the way in which they were expected to go, too much publicity causes unfavorable criticism or may even prove embarrassing in connection with the financial upholding of the undertaking. For that matter, not a few accidents of a very serious character have been hushed up in large plants in our own country, without even the technical public being allowed to get at the exact facts. If a plant like the North Tees undertaking finds it necessary and desirable to keep technical observers away, that very fact rouses perhaps unjustifiable suspicion that all is not well within the well-guarded walls. It certainly would be desirable to have the facts regarding the operation of this station set forth without undue delay and with something of the frankness that generally characterizes the successful inauguration of important public works.

Power Loops Improve Service

TWO vitally important aspects of electric service confront the transmission and distribution engineer —reliability and efficiency. In serving important loads distributed over considerable areas both are attained to a marked degree through the use of the modern power loop. Loads are increasing on many systems to a point demanding drastic handling of the problem occasioned by expansion of equipment. The pressure upon engineering departments to economize in both first and operating costs is properly heavy. Interconnection is doing its part in increasing both the reliability and the efficiency of service, but there are many cases where the transmitting capabilities of lines must be increased locally without reference to neighboring systems. Every case must, of course, be studied on its own merits. Whether interconnection is feasible or not, the possibilities of loop construction should be carefully weighed.

By departing from the purely radial system of transmission through the tying together of former dead ends, so to speak, of lines and feeder layouts, remarkable gains in regulation may be realized through the equivalent increase in carrying capacity resulting from looping. Often a comparatively small additional investment will yield a heavy increase in average line cross-section by this means. Reduced losses of energy follow, as a matter of course, for a given power total transmitted and distributed. This means a great deal to the operating company or companies concerned, but to the consumers, industrial or otherwise, it means still more in service quality. Improved sectionalization, better prospects of applying regional relay protection effectively, and in general the more reliable delivery of energy in both large and small blocks, are the reward of loop development along sound engineering lines.

Application of Common Sense to Obtaining Private Rights-of-Way

THERE is a strong tendency in many quarters toward obtaining signed agreements for all right-of-way permits, whether they involve large or small undertakings. However, it would seem advisable to divide these permits into two classes. The first one should include the building or operating of through lines, either for transmission or distribution, which involve serving a large number of customers and would necessitate a large expenditure for rerouting. In such cases a registered agreement obtained from the owners by the company upon the payment of a consideration seems logical. It is not so much a matter of either party to the transaction questioning the good faith of the other as an indication of the realization by both parties of the importance of the transaction.

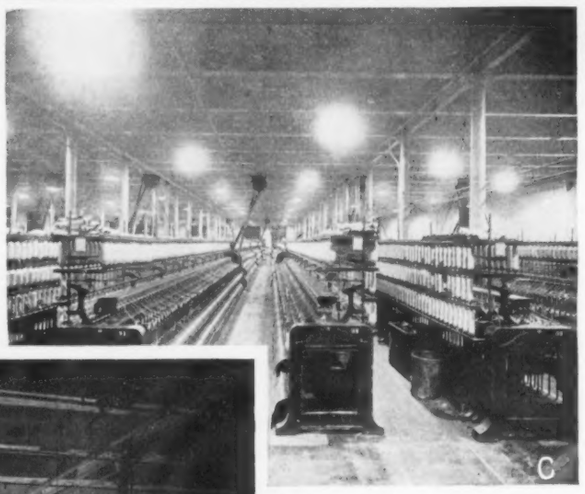
The second class would include distribution lines, such as primary or secondary extensions with poles or conduits on private property, which involve a relatively small number of customers and could be rerouted at a comparatively low cost. In this class also should be placed attachments on buildings for service wires. In such cases oral permits are sufficient, with some convenient means of indicating definitely by stakes or markings the exact location to be used, as arranged at the time the oral agreement is made.

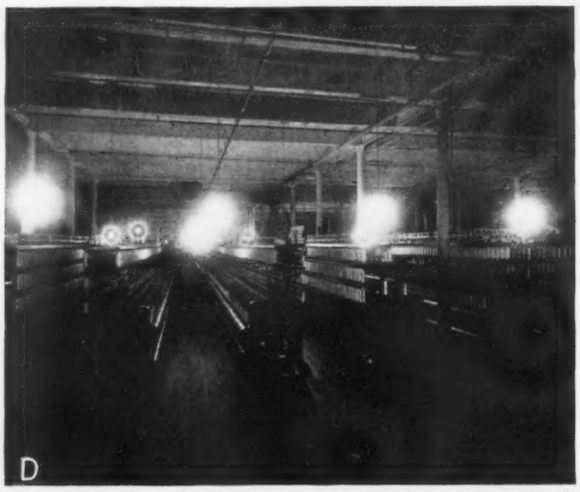
Such a method emphasizes the partnership that should exist between the public and the company that is trying to serve its needs and certainly leads toward better will on the part of the public. It must be recognized that most people are reluctant to sign their names to any paper, fearing that they may not understand all to which they are committing themselves. Suspicion may be aroused as to the ultimate intent. Furthermore, the value of such papers is very questionable so far as actual rights are concerned. In cases of conflict between the interests or wishes of the two parties the papers are of no practical value in arriving at a satisfactory adjustment because to insure co-operation willingness on both sides is necessary. Besides, it is worth while to save the cost of maintaining an organization for drawing up and executing these signed permits and to avoid delay in installing the equipment.

Central-station companies should look into this matter carefully and disregard the purely legal aspect of the situation in favor of better co-operation with the public. We feel that companies that content themselves with oral permits for all minor rights-of-way are not only saving money but improving public relations.

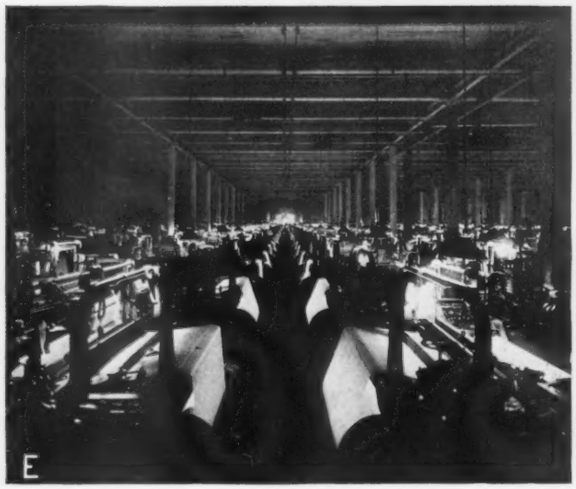
"Before" and "After" Taking Illuminating Engineering Advice

INSTEAD of an installation illuminated by incandescent lamps suspended by drop cords over the individual machines, one designed for adequate general distribution of light throughout the entire working spaces—this is the notable change at the factories of the Boston Manufacturing Company, Waltham, Mass. The camera tells an interesting story





in comparative exposures at stop f-16. The darker views were exposed from fifteen to twenty minutes, whereas the brighter photographs showing the improved lighting were exposed only from seven to four minutes. No satisfactory foot-candle data were obtainable in the older installations in view of the range between the maximum intensity on the working plane and the dimness of the aisle spaces, but in the new installations uniform distribution was secured, the foot-candles on the working plane being 8, 7 and 7 respectively. A and B show the weave room, where 280 15-watt lamps have been replaced by 90 200-watt lamps with RLM reflectors; C and D show the spinning room, where 300 15-watt lamps without reflectors have been replaced by 148 200-watt lamps with RLM reflectors; E and F show another weave room, in which 684 15-watt lamps have been discarded and 148 300-watt lamps with RLM reflectors installed.



Meter Panelboards for Large Consumers

Theft-proof and Fool-proof Method of Measuring Simultaneous Demands of Primary Customers at Several Substations and of Metering Power Factor of Two Customers at Same Place

By VERNON I. E. WIEGAND
Union Gas & Electric Company, Cincinnati

THE majority of large power consumers in Cincinnati are metered on the primary circuits, and in several cases simultaneous demands must be measured at different substations. Furthermore, some of the customers have two separate feeders, and in some cases it is an advantage to meter two customers from the same place. To meet these requirements the Union Gas & Electric Company has developed several types of panelboards which have the feature of being fool-proof and theft-proof and besides use synchronous motors for operating the timing mechanisms. The panels are wired and built complete in the meter department, where they are also tested. Then they are crated and sent to the place where they are to be installed. All that is required to install them is to set the panels in place and run the leads from the instrument transformers to the terminal board on the back of the panel.

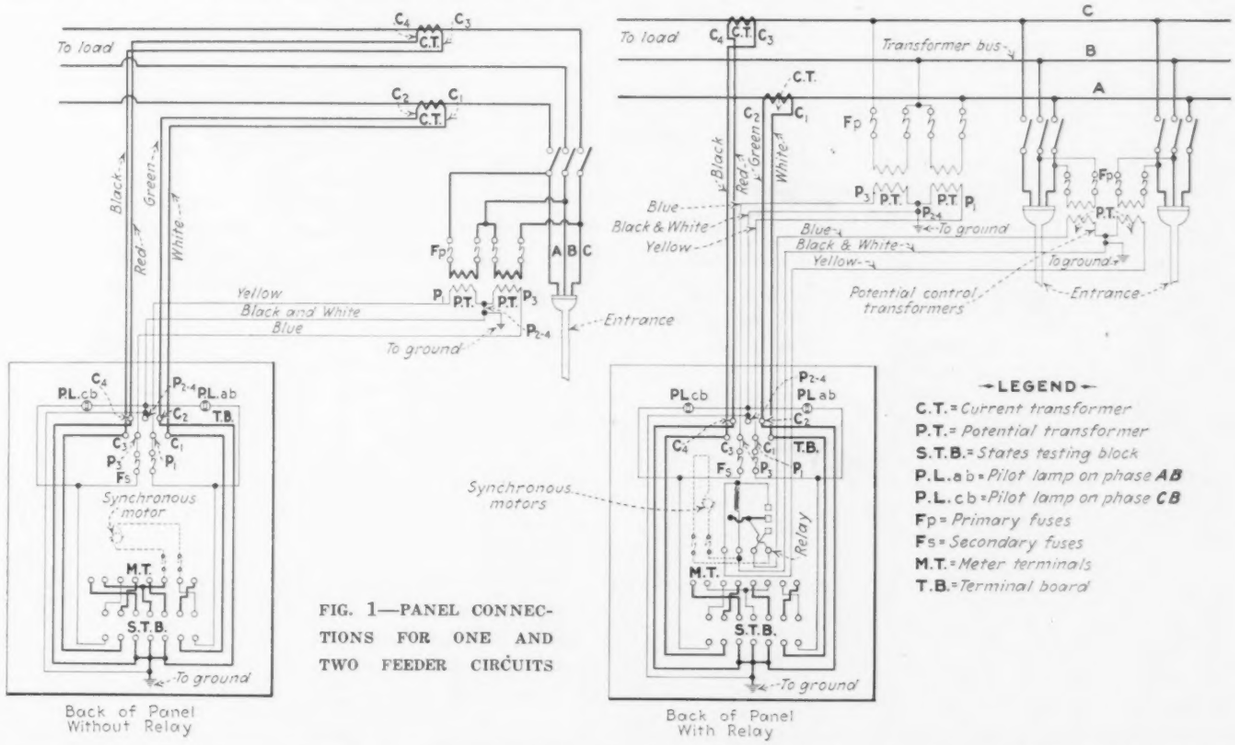


FIG. 1—PANEL CONNECTIONS FOR ONE AND TWO FEEDER CIRCUITS

The panelboard developed for a single graphic demand meter is made of ebony-asbestos board, 24 in. wide by 36 in. long by 1½ in. thick, and is mounted on a vertical frame built of 1¼-in. pipe braced by angles. Back and front views are shown in Figs. 5 A and B. The wiring on the back of the panel (see Fig. 2) is covered by a No. 14 gage sheet-iron box which can be entirely removed from the panel. This box is hung from an angle-iron brace across the top of the back of the panel, being held in place by two iron pins projecting up from this angle into holes in the top of box. Attached to the bottom of the box is a slotted L-shaped piece through which a staple passes. Into this may be inserted a lock which will securely fasten the box to the panel. The locks on all the boxes can be opened by the same key.

Secondary leads from the current and potential transformers are run into the box through a conduit which is securely fastened to the angle-iron brace by a pipe strap. The meter frame and the load lines of both current and potential transformers are grounded to the angle and strap-iron braces, the panel frame being grounded with a No. 6 wire. Hence, with the iron box in place, a theft-proof as well as fool-proof installation is assured. All wiring on the panel is made of No. 12 copper wire covered with asbestos insulation.

To drive the timing mechanism a single-phase synchronous motor is used. This motor has a constant speed, dependent, of course, upon the frequency at the generating station. More satisfactory service is expected than with a spring-wound clock. Besides, the motor makes possible the exact synchronism of charts on meters at different substations, thus allowing a simultaneous demand peak to be obtained. The wiring diagrams for these panels, a copy of which is shown

in Fig. 1, is pasted on the inside of the box covering the wiring. Where the station is supplied by only one feeder, the synchronous motor is connected across one shunt-coil element on the inside of the meter. The potential transformers must be connected ahead of the disconnecting switch and potential left on the feeder at all times in order to keep the synchronous motor running when the load in the station is disconnected.

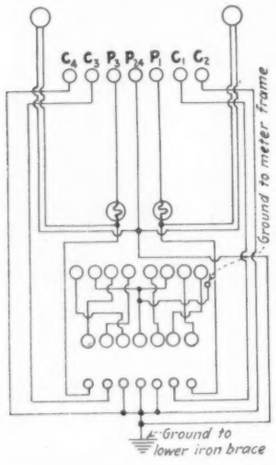


FIG. 2—BACK-OF-BOARD WIRING FOR GRAPHIC-DEMAND-METER PANEL SHOWN IN FIG. 5 A AND B.

The secondary potential circuit is fused with a 3-amp. glass-tube fuse, not of standard size and mounted on the rear of the panel. A standard 3-amp. to 30-amp. size is not used, to prevent a fuse of greater capacity than 3 amp. being thoughtlessly put into the circuit. In case of short circuits or overloads in testing, the secondary fuse will blow before the primary potential fuses. The synchronous motor is also fused with 1-amp. glass-tube fuses placed in a fuse block mounted on the front of the meter. This affords protection against short circuits in the coil of the motor. Two ruby pilot lamps are connected back of the secondary fuses to indicate whether the potential circuit is alive or not.

A terminal board is provided at the top of the panel to which the secondary leads from the transformers are connected. The terminals are lettered so that if the wiring diagram in the back of the box is followed no mistake should be made in connecting the meter. To eliminate the necessity of "ringing out" wires run in conduit and to prevent mistakes in connecting the meter in the circuit, a standard color scheme has been adopted. Corresponding colors are marked on the wiring diagram. A four-conductor colored cable is used for the current circuit and a three-conductor colored cable is used for the potential circuit. Two separate cables are used because in certain installations the current and potential transformers are in widely separated positions.

A testing block placed on the back of the panel facilitates the testing of the meter. When making tests the current transformer leads can be easily short-circuited by loosening thumb screws, and one of the potential lines can be disconnected in the same manner. To connect the meter in series with the phantom load and rotating standard a testing comb is inserted under studs provided for the purpose. After the test is completed the comb is removed and the thumb screws are screwed down, thereby automatically connecting the meter to the station load again.

In stations which have two separate distribution feeders supplying one load, a relay is required to transfer the connections of the synchronous motor instantly from one feeder to the other in case either is cut out or "goes dead."

The relay is mounted on the back of the panel, as may be seen in Fig. 4 B. Leads from the synchronous motor are run through the back of the meter frame and panelboard and connected to the relay. The latter is connected across one phase of each feeder, and the secondardies are connected in open delta. The synchronous motor is in series with a hinged contact arm actuated by an electromagnet connected across one transformer. When energized, it pulls the contact arm against the upper stationary contact, completing the circuit through the motor. When the feeder to which the relay is connected is de-energized, a spring pulls the contact arm against the lower stationary contact connecting the motor to the live feeder. Thus potential is assured on the motor at all times.

This panel requires a floor space of about 2½ x 3 ft. and is 6 ft. high.

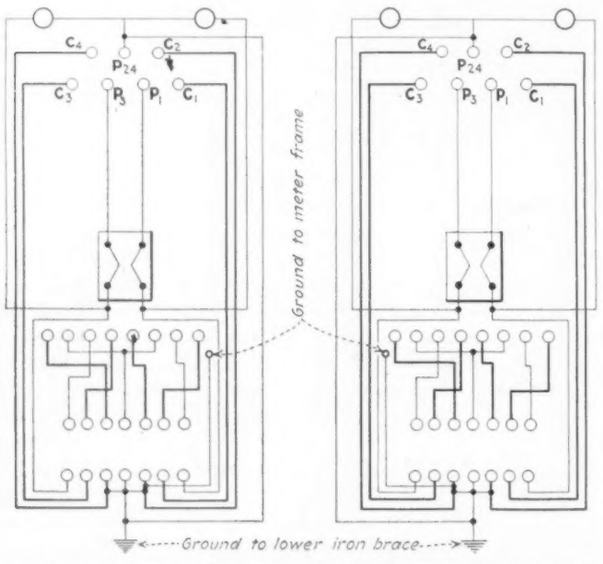


FIG. 3—BACK-OF-BOARD WIRING FOR REACTIVE-METERING PANEL SHOWN IN FIG. 5 C AND D, ADAPTED TO METER TWO CUSTOMERS AT ONE PLACE

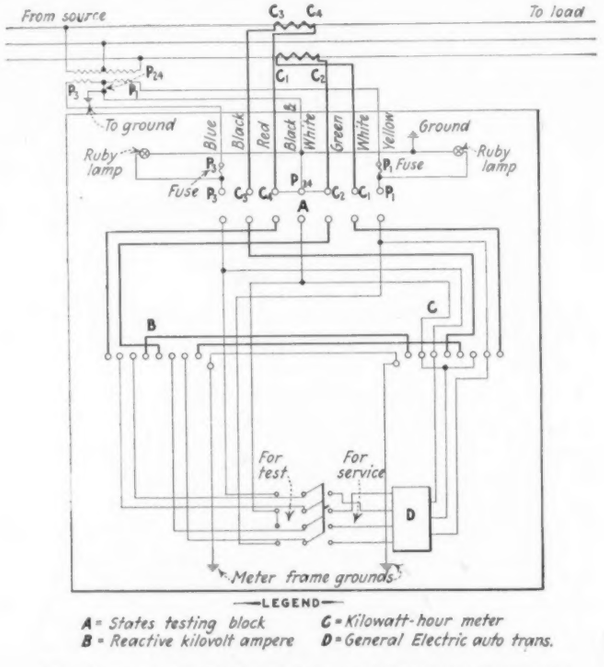


FIG. 4—BACK-OF-BOARD WIRING FOR REACTIVE-METERING PANEL WHICH IS USED AT THE UNIVERSITY OF CINCINNATI

To obtain data on customers' power factor for future billing purposes another panel was developed which is shown in Fig. 5 C and D. This board includes an auto-transformer, a testing block and a four-pole, double-throw switch. The panel is built along the same general lines as the single-meter panel which was previously described. The wiring diagram of a panel which was designed for metering two customers where the two meters could be installed at the same place is shown in Fig. 3. Except for a few features, the size and details, are the same as for the panel with the reactive and in-phase component meters. Type RA graphic-demand meters equipped with synchronous motors are used. One meter measures kilowatts and kilowatt-hours, and the other reactive kilovolt-amperes and reactive kilovolt-ampere-hours. Since the charts are exactly synchronized the power factor or kilovolt-amperes of any interval may be determined. The average monthly power factor may be obtained from the kilowatt-hour and reactive kilovolt-ampere-hour registration.

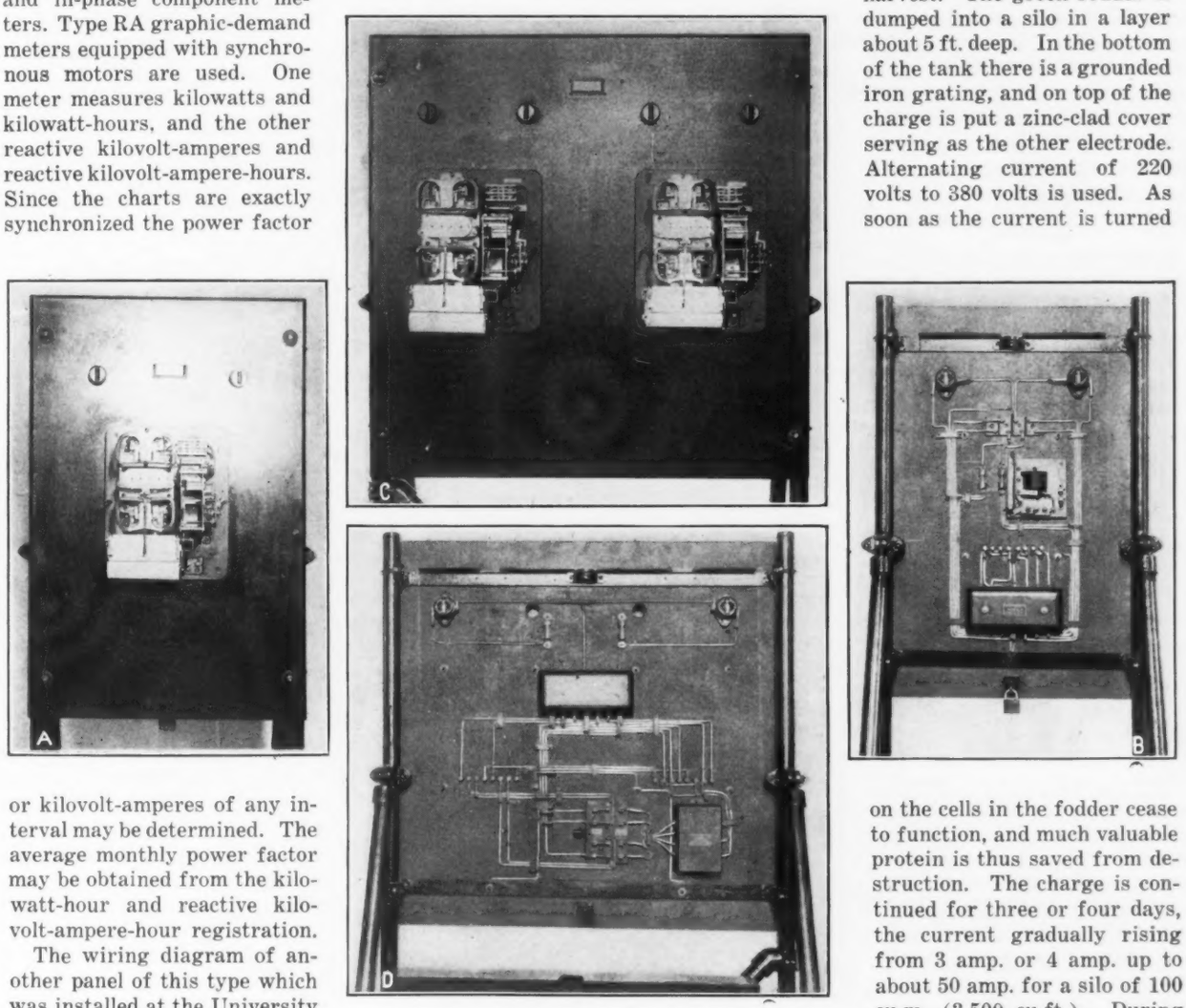


FIG. 5—FRONT AND REAR VIEWS OF TWO PANELBOARDS ADAPTED TO METER LARGE CUSTOMERS

A and B—Graphic demand meter panel. C and D—Reactive metering panel for determining power factor.

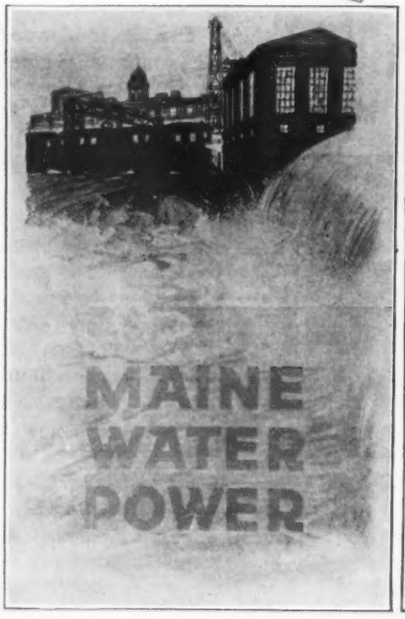
The wiring diagram of another panel of this type which was installed at the University of Cincinnati is shown in Fig. 4. The field coils of the meters are connected in series, and the potential for the meter measuring reactive kilovolt-amperes is taken from an auto-transformer. To throw the potential of the reactive-kilovolt-ampere meter from the auto-transformer directly onto the line back of the testing block a form-pole, double-throw switch is used. With this arrangement the two meters can be tested at the same time with the ordinary phantom load and rotating standard. After the test is completed the switch is thrown back into the position marked for service. This panel requires a floor space of about 2½ ft. x 3½ ft. and is 6 ft. high.

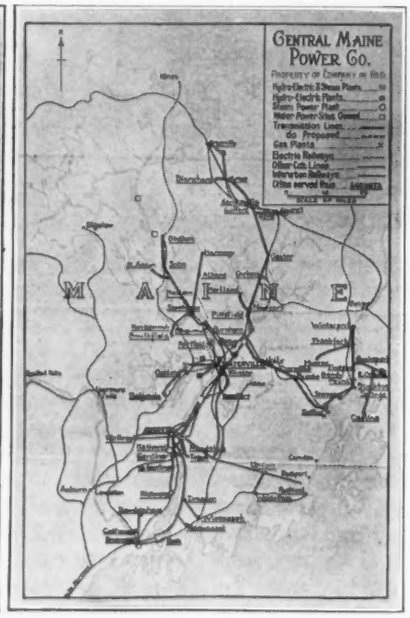
Conserving Fodder by Electricity

AN INTERESTING method for conserving green fodder by means of electric current, developed by T. Schweizer, has attracted much attention in agricultural circles in Germany, where it is claimed that the method will be of considerable importance in rural electrification, since it greatly increases the yearly energy consumption per unit area of cultivated land, being at the same time highly economical and making the farmer virtually independent of rain during the harvest. The green fodder is dumped into a silo in a layer about 5 ft. deep. In the bottom of the tank there is a grounded iron grating, and on top of the charge is put a zinc-clad cover serving as the other electrode. Alternating current of 220 volts to 380 volts is used. As soon as the current is turned on the cells in the fodder cease to function, and much valuable protein is thus saved from destruction. The charge is continued for three or four days, the current gradually rising from 3 amp. or 4 amp. up to about 50 amp. for a silo of 100 cu.m. (3,500 cu.ft.). During the treatment the temperature of the mass rises to about 50 deg. C., so that most of the destructive bacteria are killed. After this process the fodder will, it is asserted, keep fresh for months. Three electro-silos are used, one for each phase, and in each a new layer is put in every day on top of the fodder already being treated till the whole tank is full. The energy consumption is about 20 kw.-hr. to 25 kw.-hr. per ton of green fodder, and it is estimated that the use of electro-silos on German dairy farms will raise the yearly energy consumption per unit area of cultivated land to four times its ordinary value, the latter averaging 21 kw.-hr. per hectare-year (8.4 kw.-hr. per acre-year).

Advertising Copy in Customer-Ownership Sales Must Be Written by an Expert

THE POWER OF THE RIVER IS BACK OF IT ALL
Central Maine Power Company
There's a Fleck of Gold In every Single Drop
Central Maine Po
AUGUSTA, MAI
The Dividend Check comes regularly-every 3 months
$79,000.00 In Dividends
Did You Get Your Share?
This is the Company's 59th consecutive dividend
Central Maine Power Co.
Augusta, Maine
The Daily Exciter
BACK of your SHARE
CENTRAL MAINE POWER CO.
AUGUSTA, MAINE
CALIFORNIA WANTS YOUR MONEY
Are YOU one of those--
Central Maine Power Company,
Augusta, Maine





MAINE POWER
The Investment With The Big Future is The Hydro-Electric Security
The Hydro-Electric Security With the Big Future is the Central Maine Power Co., 7% Preferred Stock.

Stock Selling by a Permanent Staff

How to Recruit the Sales Force—Hiring, Paying, Training and Supporting the Salesmen—Selecting the "Prospects"—Conducting the Sale

By PERCY H. WHITING
Manager Securities Department, Central Maine Power Company

ANY power company that experiences a rapid development and consequently a steady demand for capital and is able to sell all the stock which its market will absorb is likely to pass through at least three stages: (1) Easy selling by employees; (2) intensive selling through employees; (3) selling through regular security salesmen.

In two former articles Mr. Whiting has given a graphic picture of the way to organize the initial stock-selling campaign and how to sustain stock selling by employees after the enthusiasm of the first campaign has died. In this final article of the series he gives some very practical advice on permanent security selling by regular stock salesmen. It is a phase of the problem which central-station companies are already facing and many of them must ultimately meet.

Mr. Whiting speaks with the authority of a very broad experience. His company has sold a 7 per cent preferred stock for four years at $107.50 a share. It has marketed $4,000,000 worth in Maine to 8,000 stockholders. It has secured an average of better than one stockholder to every seven customers and is still selling successfully. This campaign has been under Mr. Whiting's direction, and he has assisted in a number of successful campaigns in other cities.

SELLING central-station junior securities through regular stock salesmen should never be attempted until employee selling has slowed down below your needs. For selling by full-time salesmen is admittedly more expensive and calls for closer supervision. It presents no insurmountable difficulties, however, and is a vastly cheaper and more satisfactory method than the old way of turning the issue over to a bond house.

The first step in selling through salesmen is to recruit your sales force. Do not hurry this. Put on new men no faster than you can train them. We have dug up men ordinarily through advertisements, using either good-sized classified space or small display. You will never get the kind of salesmen you want by running an advertisement which says "Salesmen wanted" and little else.

Buy enough advertising space to give the facts and to explain the good and bad points of the position offered. Make the reader understand that you are offering him no refined bond selling job, but rather an opportunity to take on real hard work through long hours with a chance to gain good pay. The sort of advertisement we have used, in a space of two columns by seven inches, is shown on page 421.

The kind of men you do *not* want to hire are bond salesmen. I never yet knew a bond salesman who succeeded in selling preferred stock for a power company to its customers. But I have known many who failed.

Our best salesmen have usually been men who have sold something intangible, such as insurance, correspondence courses, religion, politics. Ministers, politicians, carpenters; shoe-factory operatives, head waiters, purchasing agents, farmers, stone-cutters, hotel-keepers, school teachers, merchants, house-wiring solicitors and accountants have all succeeded with us as salesmen. It does not matter so much what a man has previously done if he has energy and enthusiasm and if he is truthful, honest, determined and willing to learn about securities and about the company.

When a man answers an advertisement for salesmen we have him fill out an application blank which contains many questions. The ones we consider of especial importance are:

1. How many dependents? *(Responsibility makes for reliability.)*
2. List every job you ever held, with name and address of employer. *(Check the answers over very carefully for gaps. The man who leaves out one or more jobs usually does so for a reason.)*
3. How much time have you lost from work because of accident or injury through the past five years? Give particulars.
4. Have you any means of support besides what you earn yourself? *(Don't hire the "idle rich.")*
5. How much do you make per week from your present work?
6. What correspondence courses have you started? Finished?
7. Have you saved any money? How much?
8. How have you invested the money which you have saved?
9. Do you own a home?
10. Can you give a surety bond? *(A good question, whether or not you expect to bond your salesmen.)*
11. Did you do any work as a boy? What kind was it? *(The man who worked as a boy is likely to be used to it.)*
12. Do you *over*-indulge in cigarettes? Liquor? Gambling? Anything else?
13. How much insurance do you carry?
14. What class or trade magazines do you read regularly?
15. What books relating to your work have you read in the past year?
16. Give the names and addresses of ten people of some standing in business or in your home town as character references. We shall write these people and ask if your reputation for truthfulness and honesty is good. *(It is surprising how many we have weeded out by this test. Incidentally, we write also to every concern for which the applicant has worked.)*
17. Why do you want a position as salesman with this company. Please answer fully.

Naturally the answers to some of these questions are valuable only for what you can read between the lines. But when a man has filled out his application blank he is interviewed, and we have a rule that no salesman is to be hired unless he has been passed on favorably by at least two, or preferably three, executives. We try to have one of these executives see the candidate at least twice.

In interviewing a man we do not depend on random impressions, but use a three-sheet form which contains a list of the points we try to determine about the man. Here are a few of them:

1. Does he "sell himself" well? *(If he can't "sell himself," it is fair to suppose he can't sell anything. The man*

who sits down and waits for you to "hire" him will never sell much stock.)

2. Is he the kind of man you would be willing to invite to spend a few days in your home? (*If you would not like him in your home, is it reasonable to believe any one else would like him in theirs?*)

3. Does he get to the point in his conversation or does he wander?

4. Can he answer objections? (*Try him on some. This is important. If a man quits on objections, he will never sell much.*)

5. Is he easily discouraged? (*Tell him the difficulties of the job and see how he reacts.*)

6. Is he willing to undergo a course of study and training before he starts on the work?

7. Grade him on:

Physical Qualities—Size, "pep," health, carriage.

Appearance—Clothing, neatness.

Character—Stability (*How often has he changed jobs? Why?*). Loyalty (*Ask him about his former employees—give him his chance to tell his tale of woe. If he has never been satisfied on any other job, is it likely he will be satisfied on yours?*). Veracity (*See if he tangles himself up in his own story*). Sincerity (*Does his story of himself appear to ring true?*).

Address — Grammar good, bad or medium? Voice pleasing or otherwise? Forcefulness of speech? Does his talk carry conviction? Is he positive in his statements? Has he self-confidence? Does he state things enthusiastically?

Determination—What is he trying to become? Has he a rudder or is he drifting? (*I am indebted to various writers on sales subjects for many of these questions and would give them credit if I could remember their names. The questions have been modified considerably to suit our needs.*)

I have no apologies for going exhaustively into this matter of selecting salesmen. You can save yourself thousands of dollars if you can learn to head off incompetent salesmen at the gate.

The question of how to pay your salesmen is too abstruse to discuss here, for books have been written about payment plans. The writer's experience has been with a salary-expense-quota-and-bonus plan, which has worked satisfactorily, despite several obvious faults. The straight commission basis has much to recommend it—with the one glaring weakness that your salesmen are then working for themselves instead of for you.

Traveling and hotel expenses are another puzzle, and how to solve it depends on many conditions. But I believe it a good plan, if expenses are paid, to limit them to so much per week.

Training the Salesman

With your salesman hired and on the pay roll you face the task of training him. Our own method is crude. We allow the new man to spend two to four days in the office, during which time he goes over our advertisements, printed matter, bulletins, rules and so on. He is then turned over to a field manager who takes him out and shows him how to sell.

The field manager usually works with the new man a while in the hotel room, polishing up his sales talk. He then takes him out and begins calls. At first the field manager makes the talks and then he lets the salesman try. After each attempt by the beginner the field manager points out faults and suggests improvements. And so the new man is launched on the stormy seas of selling.

The plan we are working toward is this:

1. Prepare a manual which will contain (a) Every fact about the company that has any bearing on stock selling; (b) every talking point in favor of the stock; (c) a sales talk (we do not expect a salesman to repeat a "parrot canvass," but we do want him to have a standard sales talk to fall back on when it is necessary); (d) answers to objections.

2. Start a new salesman with a couple of days in the office, at which time he will learn the sales talk and study the manual.

3. Turn the candidate over to a field manager.

4. Give the new man two or three months' trial. If he makes good, bring him to the home office for two or three weeks' intensive study and training.

5. Keep the salesmen studying by means of correspondence course, frequent questions and the like. (We keep a library of books on selling, financing, securities, etc., which we constantly influence the salesmen to use.)

6. Send salesmen daily bulletins, with very little "inspirational matter" and a great many useful facts about selling.

7. Hold a sales school each summer.

This costs money, but it comes back fast in sales.

Supporting the Salesman

As your sales force grows your office and executive forces will have to grow with them. When you have as many as six or seven salesmen select the best as a field manager. When you have another six or seven select another field manager. If you are working a big city, where the men can come to the home office virtually every day, you will not need, proportionately, so many field managers. If the men are scattered, however, a field manager to every six or seven salesmen works best.

After you have secured and trained your salesmen you will also need some "prospects" for them to call on. If you are working among your own customers, as you naturally would at first, select your prospects from them. Have the name of your customers in the town, city or section of a city which you are going to work run off on 3-in. x 5-in. cards. If the community is not too big, the local superintendent or one of his men can go through the list and throw out most of the impossible names.

Explain carefully to the men who are selecting prospects the kind of names you want. If you do not, they will pick out a few rich men and stop there—which is the poorest list possible. We generally say to the men who select our prospects: "We want the names of every man and woman in the community who in your judgment has money to invest, or who has $500 or more in the savings bank, or who can save and invest $10 or more per month."

A compilation of figures from several campaigns I have handled in various parts of the East shows that the most sales were made in the following order, to (1) housewives, (2) merchants, (3) mill hands, (4) clerks (retail), (5) retired persons, (6) farmers, (7) teachers, (8) carpenters, (9) clergymen, (10) laborers, (11) manufacturers, (12) physicians, (13) stenographers, (14) engineers, (15) printers.

In any fairly good farming section farmers prove excellent prospects—and the farther away from civilization they live the better prospects they are, because few if any salesmen have bothered to call on them.

When we are working towns which are not located in our territory we ordinarily use as a basis for our pros-

pect list either the tax collector's books or a voting list. If a voting list is used, it is well to get some one to add to this list the names of women with money who have neglected to register. You are likely to find many of them.

We plan to call on from 10 to 20 per cent of the inhabitants of any town we serve and on from 2 to 10 per cent in towns we do not serve.

After you have listed your prospects plan to interest them in your stock by at least two forms of advertising—newspaper and direct-by-mail. Of the volumes that could be written about newspaper advertising, we have space for only these points:

1. Plan to spend from 25 cents to $1 per share on newspaper advertising. It is money well invested, and part of the cost can justly be charged to "good will," because your preferred-stock story is necessarily a "good-will" story as well. If your customers are scattered through many towns, study the field in which your newspapers circulate in mapping out a campaign. For example, in our state the Augusta paper dominates Augusta, Hallowell, Gardiner and Winthrop. So we work these four towns at once, aided by a brisk advertising campaign in the Augusta paper. Then we start advertising in another paper and work the towns it dominates. This means that we are buying advertising only in the town where we are working.

2. Make your advertisements different in appearance from the "issue" advertisements and the stiff and formal "cards" of the bond houses. If you do not know how a good financial advertisement looks, study the live ones—there are only a few, but they stand out—in the New York *Times*, Philadelphia *Public Ledger* or Chicago *Tribune*.

3. Do not under any circumstances run your preferred-stock advertising on the financial page. Most of the people you want to reach never even glance at the financial page.

4. Use big space and brief "copy."

5. Use illustrations if you can secure them. The N. E. L. A. may be able to help you. If you have a monogram or company insignia, have it made up in various sizes, as sort of a glorified "dingbat" to liven up the composition of your advertisements.

6. Do not try to cover more than one point in an advertisement. That is, devote one entire advertisement to "safety," another to "freedom from care," another to your "resale plan."

7. If you know of objections that are going to be raised, answer them in a positive way in your advertisements. For example, last summer we knew that the bond houses would work on our prospects with the argument that our bonds netted more than our stock—which was true. To offset this line of talk we advertised very strongly that our stock was tax-exempt, that it was never likely to be called, and that the company would handle all resales. Nothing was said about the bonds, but advantages that the preferred stock had over bonds were brought out. In consequence of answering these objections before they were raised we sold our stock briskly in competition with our own bonds, which were netting nearly a point more than the stock.

The newspaper advertising should be started in any town you are going to work perhaps a week before the sale begins. A couple of days before your salesmen start working send to the prospects a letter and a circular. Preparing this circular is a job that should be carefully done.

Avoid the stilted, frigid and unreadable style of the conventional bond circular. Turn the job of writing the circular over to some advertising man, with instructions to make it look as different from a bond circular as possible. Be sure he uses type that is large enough, that he uses illustrations, and that the circular not only gives the facts about the security but that it arouses a desire to buy. This desire to buy will come if you bring the prospect into the picture and show him how he profits by the transaction.

HIGH GRADE MEN WANTED
AS SECURITY SALESMEN

On our security selling force we can use two or three salesmen.

A man, to make good at this work, must be able to meet on equal terms the very best people of our communities. Yet he must not be too proud to call on **any one** or too elegant to work hard and steadily at all hours, under all weather conditions, over all kinds of roads, in big towns and small. He may have to travel afoot through mud and slush, will often stop at bad hotels and will generally have to work nights.

Knowledge of securities not required. Selling experience desirable but not absolutely essential. The candidate must have a clean record and must have proved on previous jobs that he is a WORKER!

If you are this sort of a man and you want a position that entails plenty of hard work, but pays expenses, a small salary and liberal commissions, and has a real future—write us, giving full facts about yourself.

Remember—to succeed on this job the man must be high-grade and willing to punish himself with work. The position offers not only good pay but a chance for advancement.

Send your application to the Securities Department.

CENTRAL MAINE POWER COMPANY,
Augusta, Me.

As soon as your mailing pieces go to your prospects the sale can begin. If your men are all working in or from the same town, start each day with a brief sales meeting. Polish up sales talks, rehearse answers to objections, swap "openings" and "closings," and make the meetings practical helps in selling.

Sort out your prospect cards by streets and sections to save the salesmen unnecessary pedestrianism. Watch out, however, that you don't keep any salesman too long in one section, which may be unusually bad or unusually good. Change your men around frequently.

Be sure that every salesman calls and reports on every prospect whose name is given to him. For this purpose we use the card shown on page 418. These report cards are filed and used the next time that the community is worked. By this method we build up a wonderful prospect list.

Impress particularly on salesmen the fact that each prospect they call on should yield them other prospects. In other words, somewhere in each sales talk they should say, in effect: "You believe that this stock is a good investment. Can you not give me the names of some of your family or friends who might like to buy?" Prospects secured on this basis are worth materially more than ordinary prospects. Require your salesmen to keep and send you a record of all calls made and sales talks delivered.

As the sale progresses some of your salesmen will do well, while others will slip. Keep your field managers busy helping the men who need help and watch them to see that they do it. A field manager much prefers to work with the men who are going strong—which is a

poor practice. If the salesmen are working away from home, personal letters of commendation, advice and stimulation from the home office are also useful.

It was our plan when we started to work a city or a group of towns and then to "close" that territory and award it to a salesman, who would have the exclusive right to sell there as long as he produced. We found that an average "territory" numbered from 20,000 to 30,000 people. The "closed territory" plan has advantages and also drawbacks for the territory man is less expensive, but he is apt to slip into a rut.

We have changed several times from the campaign method to "closed territory" and back again. My present belief is that the "closed territory" plan is best, provided you keep at the home office a permanent list of the prospects in every town and provided you give each salesman each week a list of the people he is to call on—and see that he does it. In other words, the salesman's activities have to be directed almost altogether by the home office.

If you find that "closed territory" selling is fading, try to freshen it up by campaigning again through the entire territory, and then go back to closed territories again.

The selling plan here outlined can be used successfully for indefinite periods at a reasonable cost. Its continued success depends on good advertising, careful training of salesmen, good field management and intelligent direction. The system has faults, but with all its faults selling by salesmen produces large amounts of preferred-stock money over long periods at low cost—which is about all that could be asked of any system of financing.

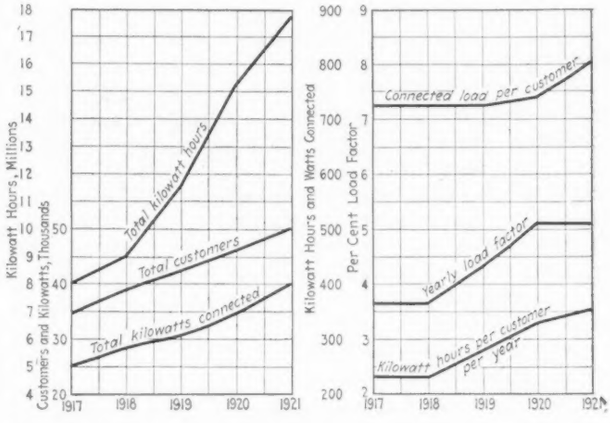
What Is Residence Load Factor?*

Is It Improving? Some Curves on the Domestic Load and Some Considerations that Should Be Kept in Mind

BY J. A. ROCKWOOD
Portland Railway, Light & Power Company

IT IS not practicable to determine with accuracy the load-factor of residence business because of the difficulty of determining what the connected load is. Ordinarily appliances are not counted in determining the connected load of a customer, although the kilowatt-hours used by these appliances constitute quite a proportion of the total used by residences. The smaller residences are taken at a flat figure, as a minimum, regardless of how many lamps are actually installed. The sizes of lamps and other installations in any given residence are to a greater or less extent being changed, and it is impracticable for a company to keep in touch with the changes that take place. The result is that while most companies keep records of the kilowatts installed for residence customers, it is very evident that these figures may be in error to a considerable extent. However, while it may not be possible to get the exact ratio of average load to connected load, it can be approximated and the trend of the changes that are taking place can be measured.

In the accompanying charts are given some data that illustrate the changes that are taking place in the residence business. One of the charts gives some statistics of the gross growth of the residence business. On this chart are platted the kilowatts connected, the total number of customers and the total kilowatt-hours consumed of the residence class. It shows that while the customers have increased approximately one-half, the kilowatt-hours consumed have more than doubled in the five-year period for 1917 to 1921. It is evident from this that the consumption is growing at a much faster rate than the customers. The other chart gives



THE NUMBER OF CUSTOMERS INCREASES ONE-HALF AS RAPIDLY AS THE KILOWATT-HOUR CONSUMPTION

the same information on a unit basis. The connected load per customer shows comparatively little change in the five-year period, although the last year or two shows the effect of the increasing number of ranges.

The interesting curves are those of the load factor and kilowatt-hours per customer. The load factor increased from about 3.6 in 1917 and 1918 to about 5.1 in 1920 and 1921. This is an increase of about 40 per cent in that period. The kilowatt-hours per customer increased from about 232 in 1917 to about 356 in 1921. This is an increase of 124 in the period or more than 50 per cent.

The earnings per kilowatt-hour in this same period decreased between 20 and 25 per cent, while the total earnings per customer increased less than 20 per cent. All these facts together prove without question that there has been a very decided increase in the use of electrical energy in residences in the past five years.

This increase in residence business may be laid to a number of causes: Range load; appliances, especially small heaters; more outlets and increased size of lamps; increased use of light and appliances. The increase in the consumption began the month after the armistice was signed and has been increasing ever since. The rate of increase, however, was not as great in 1921 as it was in 1919 and 1920. When these unit figures are plotted month by month, the remarkable changes that have taken place are all the more noticeable.

In conclusion, it is evident that in this specific case there has been an improvement of about 40 per cent in the load factor and about 50 per cent in the average consumption per residence customer. This indicates the possibilities of residence business if developed to a reasonable extent. The increased use of electricity in the home offers an opportunity to smooth out the load curve and to offset the effect of industrial depressions.

*Paper presented before the Northwest Electric Light and Power Association, Boise, Idaho.

VANCOUVER CONVENTION
American Institute of Electrical Engineers

Papers on Transmission and Insulator Developments Form the Basis of an Interesting Discussion—Electrical Precipitation Processes and an Educational Symposium Also Arouse Comment

THE eleventh annual Pacific Coast convention of the American Institute of Electrical Engineers was held at the Hotel Vancouver, Vancouver, B. C., Aug. 8 to 11 inclusive, the attendance reaching about 225. The convention program was filled with interesting technical features, with which were interspersed valuable entertainment and inspection trips. The subject which called forth greatest discussion was that of high-tension insulators coupled with long-distance transmission and the features of the forthcoming 220-kv. transmission schemes in California. As reported in the issue of Aug. 12, retiring President William McClellan, in whose administrative year the present convention was held, was present during the first half of the convention and made the principal address at the dinner on Wednesday evening.

Transmission the Keynote

CALIFORNIA has had a very rapid growth in the demand for electric power, and this condition has resulted in a rapid increase of load on the transmission lines and generating stations of the various electric companies supplying this power. The hydro-electric developments in California are in the mountains quite a distance from the load, with the result that the question of transmission becomes very important. R. J. C. Wood described the 220-kv. transmission system of the Southern California Edison Company. This company at present has two single-circuit power lines, 241 miles long, from its Big Creek development to Los Angeles. In order to take care of the power demand the company had the alternative of either duplicating these lines or of raising the voltage upon them and decided upon the latter procedure as being the more economical. The existing lines are at 150 kv., so that a doubling of capacity will result by raising the voltage to 220 kv.

In order to take care of the existing generating stations, etc., built for the lower voltage, auto-transformers are used, transforming from 150 kv. to 220 kv. Six sectionalizing switching stations will be built in the new line so that the rebuilding may be possible with a minimum amount of trouble, and this amount of sectionalization permits tests to be made very readily on the different sections of the line. A future plan is to use automatic oil switches to secure sectionalization in place of some of the air-break cross-over switches now used. A 30-mile extension of the Big Creek line will be built from the Eagle Rock substation to a new substation which will lie east of Los Angeles and deliver power to a section of that city. Upon the completion of this line there will be 270 miles of 220-volt transmission.

Preliminary to the installation a considerable amount of investigation and research was carried on, both in the factory and in the field. The insulator question was one of the largest problems to solve, and after tests were made it was determined to use suspension insulators in preference to any other design, while in order to obtain better voltage distribution between the different units in the string ring shields were used. All the suspension strings will have a ring shield, 28 in. outside diameter, around the first unit. At the outer positions on the tower the arcing horns with which the top insulators are now equipped will be left in position. The center suspension will have the arcing horns removed and a ring substituted.

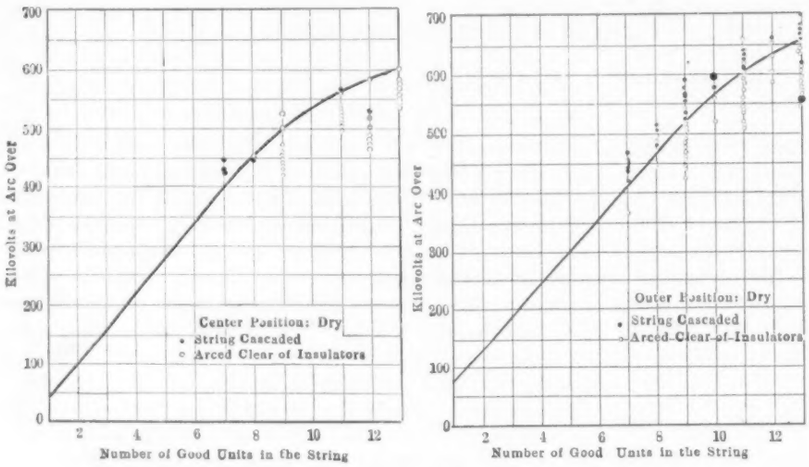
In connections with the field tests one section of the line was energized to 280 kv. for one month and to 241 kv. for about five months, extending through the greater part of the rainy season. Considerable care was taken to obtain reliable measurements of voltage current and corona losses, and the results of these tests are pretty largely described in the issue of the *Electrical World* of Feb. 11, 1922, with a corrected table of coefficients in the May 6 number.

Condensers Used for Regulation

It is thought that a total condenser capacity of 180,000 kva. would be required to regulate for 240,000 kw. transmitted over two lines with zero regulations from generator to substation, the power factor of the load being taken at 0.85 lagging and economic limitations will determine the amount to be used on the system. The 220-kv. oil switches will have a rupturing capacity of not less than 1,200,000 kva. Disconnecting switches for station use will be mounted upon separable post-type insulators. The existing clearance to ground is 25 ft., and on the reconstruction for 220 kv. a great percentage of the towers will have to be increased in height to afford a minimum clearance of 30 ft. to ground in all country susceptible of cultivation. The towers will be raised bodily without interference with conductors or ground wire, and a structural-steel, vertical-sided extension frame will be bolted between them and their old foundation anchors. No lighting arresters are to be installed on the new 220-kv. line, although the existing 60-kv. arresters now in service will remain in operation. The method now used of breaking arc-overs is to lower the fields of generators and synchronous condensers until the arc breaks, and upon building up the field once more the generators pull into step if they have fallen out of synchronism. Service is resumed in about one minute on an average. Plans are under way to make this operation automatic and thus insure a great saving in time. The author felt that transmission

at 220 kv. and the equipment required for this voltage is standardized and can be used with great confidence in its reliability.

In presenting his paper Mr. Wood stated that he had made some tests at 280 kv. and that reports came to him from real-estate agents that the line was sounding like the hissing of "venomous serpents" and people were being scared away from the community. As a matter of fact, as far away as a thousand feet from the line it did sound somewhat like frying eggs. When the voltage was reduced to 240 kv., however, there was no indication of any higher voltage than that now used in operation, namely, 150 kv.



A SUMMARY OF THE ARC-OVER TESTS MADE AT PITTSFIELD AT 60 CYCLES ON INSULATORS WITH AND WITHOUT SHIELD RINGS

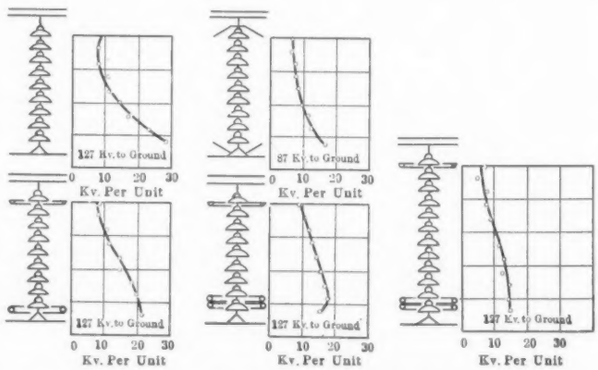
William McClellan, New York, pointed out that the developments discussed by Mr. Wood constitute engineering of the highest type in that it is breaking into new fields. There is plenty of routine engineering, he said, but this is real engineering in that it tackles the problem of looking keenly into the future.

W. A. Hillebrand, San Francisco, asked if any experiments had been made on the disconnecting switch to control the direction of flashover. Mr. Wood said that the only attempt which had been made was to mount a galvanized iron pipe at the outer contact end of the switch in such a way as to try to induce a horn-gap action, but that the flash did not follow this pipe at all, even though the pipe was only three inches away from the end of the switch, but rather formed a large inverted "U" from the end of the knife blade to the outer contact. Mr. Hillebrand also asked if provision had been made for controlling high-frequency discharges in the substation, Mr. Wood replying that they were skeptical of any high-frequency effects but nevertheless were prepared for them.

In reply to a question regarding the charging energy, Mr. Wood said it has been calculated that there will be a charging energy of 50,000 kva. At the lower end of the line synchronous condensers are provided and the generators and synchronous condensers will all start at once. Aside from the magnitude of the quantities involved, he said, no new operating problems are anticipated.

Mr. Wood also discussed a surge recorder which had been devised to get approximate measurements of the value of surge voltages. This surge recorder consists of six points set at varying distances opposite a metal plate. The first gap is set at 10 per cent over voltage, the second at 25 per cent, the third at 50 per cent, the fourth at 100 per cent and the fifth at 200 per cent. A kodak film moves along between the points and the plate, and as surges occur they are recorded on the film. So far the highest surges recorded on the 150-kv. line have been not more than 100 per cent of line voltage, and these highest surges have occurred when the bus was killed in the station in order to change the film. Records were also obtained at the time of opening the line at the other end, but so far no records of 200 or 300 per cent above normal have been secured, and even if they did occur this voltage is probably not enough to flash over. The line has, however, had some unexplained flashovers when, so far as outward observations indicated, the line was under normal operation, with no switching, and in fair weather. All of a sudden a flashover occurs, the voltage lowers, the flash dies, the voltage rises and everything is right again. Mr. Wood said the engineers were bending all their energies to learn what is going on in the line because these flashovers look as if they were the result of the simultaneous happening of three or four out of some eight or ten things which might happen. If the flashover were due to any one thing, one would expect to have a few flashovers every day.

Joseph Mini, Jr., San Francisco, said he had visited the system during the high-voltage tests and while there was visible corona at 280 kv., he would have to be told that the voltage was on the line at 220 kv. or 240 kv. Mr. Mini pointed out that it would not be so easy to break flashovers when both sending and receiving ends of the line are connected star-grounded on the high-tension side. At present the generator end is connected in delta and the receiving end in star. Mr. Mini suggested that the way to break a flashover is to set the relay system light for ground trouble and heavy for trouble between phases, though naturally there must be duplicate lines in order to make use of this principle. Carrying his discussion of duplicate lines into method of operation, he brought out the point that if one line is fully loaded and it is desired to add the second, there is a large phase-angle difference at the receiving end



POTENTIAL GRADIENT ON INSULATORS WITH AND WITHOUT SHIELD RINGS FROM TESTS MADE AT STANFORD

which would cause a great disturbance if the two receiving ends were then connected together in parallel. Mr. Mini raised the question whether it would not be best to make the original connection at the receiving end, to use another generator at the generating end and to pull up some of the load on to this new generator until the two lines were in phase at the generating end and then connect the two in parallel there.

A great many engineers have difficulty in using the hyperbolic solution for transmission lines, and for this reason C. H. Holladay presented, in a paper entitled "A Graphic Method for the Exact Solution of Transmission Lines," a scheme whereby charts and graphs can be used to determine a solution on an accurate basis. Starting with the voltage at the generator on open circuit, the receiver voltage is higher, owing to the line capacity drawing a leading current through the inductance. As the line is loaded with a lagging current, this voltage rise is counteracted by the impedance drop. Under load the generator current is made up of the charging current and the load current, and these values are expressed in a vector diagram from which it is possible to read directly power and power factor as well as condenser kva. necessary for voltage regulation.

EFFECT OF TERMINAL APPARATUS

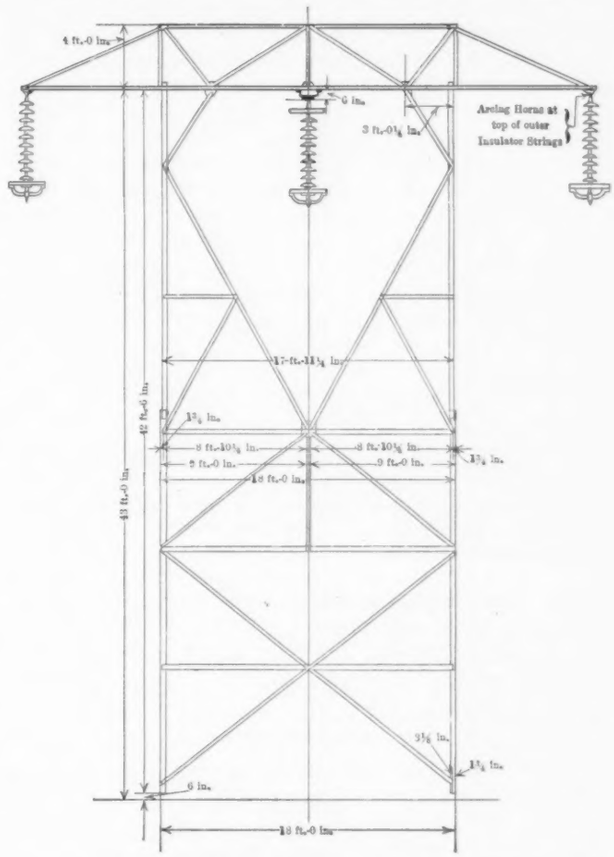
Very frequently it is convenient in making the electrical calculations for a long transmission line to include the effect of the transformers and other terminal apparatus. Herbert Bristol Dwight, in a paper entitled the "Electrical Characteristics of Transmission Systems," gave a method for doing this on constant-voltage lines, which are the type of line commonly used, especially for high-voltage and high-power systems, since synchronous condensers are generally part of the equipment. The necessity of using the hyperbolic theory in calculating the lines is pointed out, and specific examples of papers and problems solved without the use of this theory are discussed and errors indicated. The method of determining the size of conductor and the features of loading and controlling a constant-voltage transmission line proposed by Mr. Dwight is to draw a circle diagram for the line in question. This shows the operation of the condensers under all conditions of load and gives the amount of load which can be carried by the line at the voltages considered; in addition, the efficiency of transmission and power factor at the generators for various loads may be conveniently plotted above the diagram.

The paper by Shungo Furui scheduled could not be presented, as Mr. Furui, who had intended to present it in person, had unexpectedly been called to Japan.

C. E. Magnusson, in discussing transmission-line calculations, pointed out that hyperbolic functions take into consideration both length and phase of the quantities under consideration, whereas circular functions neglect the variations of length. The whole question then is whether the particular case in question at any time is such that the errors resulting from the use of circular functions are negligible.

Sven Barfoed, San Francisco, showed from diagrams which he placed on the blackboard the great variation in kilovolt-ampere capacity in synchronous condensers necessary for power-factor correction as the power factor varies and the consequent lack of necessity for absolute accuracy in its determination.

Ivar Herlitz deprecated the debate over method. If complete accuracy is necessary, he held, naturally the hyperbolic method is the only one to use; but for any line it is possible to learn exactly how much error the use of circular functions introduces and, knowing this



STANDARD BIG CREEK TOWER WITH INSULATORS AND SHIELD RINGS AS FINALLY ADOPTED

error, one can use circular functions or not as he deems necessary.

H. L. Melvin, Spokane, said that each operator probably makes his calculations in his own pet way, depending upon the requirements of his own system, using hyperbolic, circular, diagrammatic or other graphical means to fit the case, and that most operators can use any of these methods as needed. But, in any case, Mr. Melvin thought, an engineer was helped by the use of vector diagrams. He personally liked the Perrine-Baum diagram. Mr. Melvin would not minimize the importance of exact solutions. These, he said, must be known in order that a person may intelligently use less accurate methods.

John R. Dunbar, Hamilton, Ontario, brought up the question of a standard rule for the drawing of a vector diagram showing kva., pointing out that while the A.I.E.E. Standardization Rules, following the recommendation of the International Electrotechnical Commission at Turin, Italy, in 1911, provide that a leading current shall be plotted counter-clockwise to the electromotive force in the zero position—in other words, that impedance shall be represented by the formula $Z = R + jX$—there is no provision for the kva. diagram. Expressed mathematically, shall one use the conjugate of E or the conjugate of I in working out the

vector expression for kva.? Thus, if I is multiplied by E, it gives:

$$I(\cos \phi_2 - j \sin \phi_2) \times E(\cos \phi_1 + j \sin \phi_1)$$
$$= EI[\cos (\phi_1 + \phi_2) - j \sin (\phi_1 + \phi_2)]$$
$$= EI (\cos \phi - j \sin \phi).$$
$$= EI \cos \phi - j EI \sin \phi.$$

But if E is multiplied by I, it is:

$$E(\cos \phi_1 + j \sin \phi_1) \times I(\cos \phi_2 - j \sin \phi_2)$$
$$= EI[\cos (\phi_1 + \phi_2) + j \sin (\phi_1 + \phi_2)]$$
$$= EI (\cos \phi + j \sin \phi)$$
$$= EI \cos \phi + j EI \sin \phi. \qquad (2)$$

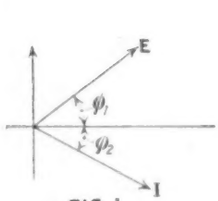


FIG. 1

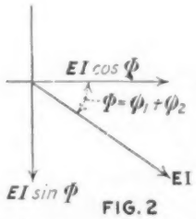


FIG. 2

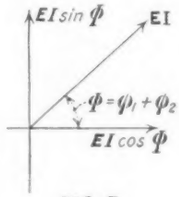


FIG. 3

FIGS. 1, 2 AND 3—E-I VECTOR DIAGRAM "LAGGING" CURRENT; KVA. VECTOR DIAGRAM "LAGGING" WATTLESS KVA. AS INDICATED BY FIG. 1 AND EQUATION 1; KVA. VECTOR DIAGRAM "LEADING" WATTLESS KVA. AS INDICATED BY EQUATION 2, BUT NOT BY FIG. 1

This latter makes a diagram which shows "leading" kva. with "lagging" current. The standards committee should, therefore, add a rule defining kva. as a quantity capable of vector representation in transmission line diagrams, etc.

Insulators Show Improvement

ACCURATE information showing the actual operating performance of insulators during a period of years was presented in a paper entitled "Failure of Disk Insulators on High-Tension Transmission Line," by Harrison D. Panton. The tabulated results, given in three tables, are based on the operation of a 100-kv. double-circuit steel-tower line, 97 miles long, during the period from March, 1912, to October, 1921. A principal feature of this transmission line are double-circuit steel towers, 73 ft. high, which support two three-phase circuits of No. 1/0 six-strand copper wire. The three conductors of each circuit are on the same side of the tower. The vertical spacing between these conductors is 9 ft., and the horizontal spacing of the two circuits is 15 ft. for the bottom and the top conductors and 21 ft. for the middle conductors. As built originally, the horizontal spacing of the two circuits was the same for all three conductors, but in 1916 the spacing between the middle conductors was increased to 21 ft. by putting a 3-ft. extension on each end of the middle arm. The average span length is 680 ft. The disk insulators used are of the cap-and-pin type, being the No. 1113 Thomas type manufactured in 1911. These were replaced on tension assemblies in 1915 with General Electric Hewlett disks, and the number of Thomas disks used in all suspension assemblies was increased from six to seven. This insulation is used at present. Tables I, II and III refer only to the Thomas No. 1113 disks used on suspension assemblies, there being on this line a total of 4,452, such assemblies consisting of a total of 31,164 disks. The remarkable thing about these tables is that instead of No. 1 disk showing the greatest tendency to failure, No. 7, or the one nearest the tower, shows the greatest tendency to failure. If these results are corroborated by other experiences, this will tend to show that the use of the shield ring or graded disks on the lower side of the insulator is misdirected work.

INSULATION IN NEW ZEALAND

"Test and Investigations on Extra High-Tension Insulators" was the title of a paper by C. Coleridge Farr and Henry E. R. Philpott of New Zealand. This paper took up tests made for the Public Works Department of New Zealand on insulators on the Lake Coleridge electric power supply system. A complete description of the tests made was given. These tests were inaugurated very largely because on this transmission system with over 5,000 insulators more than 800, or 16 per cent, had to be replaced in six years owing to failure. The experience of the authors indicated that failure was due mainly to initially poor insulators coupled with mechanical weakness. The authors suggested that insulators for extra high-tension work should, before they are put into service, be subjected, individually in the case of suspension units and on each shell in the case of pin insulators, to flashover pressure for a definite period at both high and low frequency; also that a percentage of each shipment of insulators should be subjected to a hydrostatic pressure of 2,000 lb. per square inch, with the insulator placed in a solution of fuchin for about a week.

In the design of insulators it is desirable to obtain

TABLE III—FAILURES LOCATED ON TEST FROM 1912-1921

Arranged according to years and location of disks in the assembly, disk No. 1 being adjacent to the conductor. Total number Thomas disks on suspension assemblies 31,164; prior to 1916, 26,712.

Disk No.	1913	1914	1915	1916	1917	1918	1919	1920	1921	Total
1	14	26	30	54	51	41	42	36	100	294
2	8	22	11	21	20	44	22	69	111	217
3	8	22	16	20	48	63	40	124	237	341
4	9	23	10	26	44	85	60	127	254	384
5	5	14	19	30	55	88	67	116	272	394
6	3	23	24	21	52	88	40	160	295	411
7	...	...	...	43	71	103	42	170	303	429
Total	47	130	110	215	341	512	313	802	1,572	2,470
Per cent total No. disks.....	0.2	0.5	0.4	0.7	1.1	1.6	1.0	2.6	5.1	.....

TABLE I—FAILURES LOCATED ON TEST FROM 1912-1915, SIX-DISK ASSEMBLY

Arranged according to location of disks in the assembly, disk No. 1 being adjacent to the conductor.

Disk No.	Top Wire	Middle Wire	Bottom Wire	Total
1	15	18	37	70
2	6	10	25	41
3	11	14	21	46
4	13	13	16	42
5	10	11	17	38
6	24	14	02	50
Total.....	79	80	128	287

TABLE II—FAILURES LOCATED ON TEST 1916-1921, SEVEN-DISK ASSEMBLY

Arranged according to location of disk in the assembly, disk No. 1 being adjacent to the conductor.

Disk No.	Top Wire	Middle Wire	Bottom Wire	Total
1	112	112	100	324
2	101	96	90	287
3	193	204	135	532
4	246	203	147	596
5	237	210	181	628
6	259	211	186	656
7	281	239	212	732
Total.....	1,429	1,275	1,051	3,755

good dielectric strength, and in that respect flashover voltage, shell thickness and impulse ratio must also be considered. In a paper entitled "An Overpotential Test for Insulators" G. W. Lapp stated that the ratio of puncture voltage to the product of flashover voltage times impulse ratio may be taken as the electrical factor of safety in service.

To make it possible to test insulators at any definite voltage desired from flashover to high puncture, an overpotential test was devised and used in which the insulator is placed in an insulating dish which holds a sufficient depth of oil to form an electrical flashover seal at the rim of the insulator, at the same time leaving the head and center part of the shell exposed to the air. The inside terminal is connected with a conductor passing up through the center of the dish. In effect the dish becomes part of the insulator, which temporarily, for testing purposes, acquires an extended flashover distance sufficiently long to prevent flashover at the chosen testing voltage.

From records of puncture under oil of 1 per cent of several thousand suspension insulators, representative of six months' production, minimum and average puncture values were increased about 20 per cent and 15 per cent respectively above previous values on similar units tested by liberal flashover with impact. Maximum values of puncture were fully as high after applying the overpotential test. In no case was an oil puncture value below the overpotential used on the test. The distribution of punctures throughout the five minutes of test showed that two-thirds of the failures occurred in the first and second minutes and failures diminished in succeeding minutes, indicating that at the voltage of test no evidence of dielectric fatigue had appeared.

Thus this test applies to an insulator a definite chosen potential in excess of its highest normal flashover voltage, eliminates doubtful material and so increases the factor of safety.

TEST TOO EXPENSIVE

In discussing the insulator papers, C. E. Skinner, East Pittsburgh, Pa., pointed out that porcelain is essentially a conglomerate of elements, each individual unit having its own personal character due to its manufacturing history, and it is therefore necessary to test each individual unit and not depend upon batch testing. What the industry is looking for is a test to eliminate those insulators which will give trouble if used. No test has been, and none probably will be, devised to equal service conditions, and there must be an economic balance between the number of insulators eliminated by test and the number used. Certain conditions might make the Lapp test useful if it would eliminate the right ones, but these extra ones must be paid for some way and the entire conclusions would have to be based upon the assumption that the factory procedure was absolutely uniform. It is, of course, absolutely impossible for any test to eliminate insulators which would become defective later owing to their mechanical history while in use. Every one will welcome any test that helps give better insulators, Mr. Skinner said, and the Lapp test appears to afford a method which will be particularly useful to designers and manufacturers in developmental work, but he expressed his doubt as to its ever being useful as a routine test.

E. E. F. Creighton, Schenectady, N. Y., pointed out that the Lapp test meant a more severe test, that it would cost more, and that it would take out of service more insulators which the operating companies in the end would have to pay for.

C. Fortescue, East Pittsburgh, Pa., in a written discussion called attention to some errors, as he called them, in Mr. Lapp's suggestions and to some of the special features of the test. Mr. Fortescue said that the actual frequency of the test may be many times the 100,000 to 200,000 cycles mentioned by Mr. Lapp owing to the damped oscillations induced by the flashover itself. Mr. Fortescue argued for the greater dependability of the 60-cycle test for routine work and pointed to the fact that the potentials to which insulators are subjected under routine tests now used are several times more severe than any surge they are likely to meet in service.

Mr. Fortescue also deduced points in favor of the Lapp test—that the insulators are not flashed over, that the testing equipment does not have such severe service as in case of flashover, and that there is absence of deafening noises and the usual headache-causing ozone. Another good feature is that the value at which the test is made is under control so that any economic test value may be used. But Mr. Fortescue emphasized that the purchaser of special insulators would have to pay a special price or else the purchaser of standard insulators would have to bear part of the cost of losses sustained in selecting insulators for the more exacting service.

QUARTZ LENSES RECOMMENDED

Allen W. Eshelby, Seattle, called attention to the incomplete information which photographs of flashovers taken through ordinary glass lenses present. Mr. Eshelby mentioned some flashover pictures taken with quartz lenses, which are not opaque to ultra-violet rays as are glass lenses, and said that these flashover pictures give much more complete information as to the actual behavior of the flashovers than do those pictures which show only the visible part of the spectrum. Mr. Eshelby said he thought that the greater use of quartz lenses would show much that is not now known.

R. J. C. Wood, Los Angeles, in discussing Mr. Panton's paper, referred to the figures which showed that in early years, 1913 to 1917, No. 1 disk seemed to fail the most, whereas since 1917 No. 7 disk, that nearest the point of support, has taken first place. It is common knowledge that in the years 1913 to 1917 insulators were different from those of today. Mr. Wood wondered if the explanation were not that the earlier failures were due to electrical causes, whereas the latter-day failures are due to mechanical causes.

W. A. Hillebrand, San Francisco, said he thought the record of failures over the period of seven years was one of the lowest known. There is, however, a comparatively high rate in the dead-end position, but this was accounted for by the heavy sleet which had caused an average of about one break per mile so that the dead-end had been placed under heavy mechanical strain. Mr. Hillebrand pointed out in addition that perfect results in porcelain were never to be expected, and Mr. Skinner said that if porcelain manufacture ever became uniform, it would probably be uniformly bad.

E. E. F. Creighton discussed some of the manufacturing reasons for non-uniformity in porcelain, asserting that a perfect piece of porcelain was perhaps an accident. He referred to tests which have already been recorded in which dye was sucked into porcelain by the use of a vacuum and the porcelain later broken in the attempt to find faults of manufacture and also his

"Ferris wheel" tests for deterioration under hot and cold variations.

Ivar Herlitz, Riverside, Cal., whose experience has been principally in Sweden, quoted from a paper by W. Borgquist, director of the Bureau of Power, Board of Water Falls, Sweden, telling something of Swedish experience with insulator development. He made the following points:

SWEDISH PRECAUTIONS TO REDUCE FAILURES

1. That in the years preceding 1914 an extensive study of the mechanical and electrical aspects of the insulator problem was made, this investigation resulting in the design of a suspension insulator with the following characteristics: (a) The porcelain was, as far as possible, made free from tensile and shearing stresses. (b) The cap was corrugated at its lower edge and the pin at its top only, giving the metal greater freedom to expand axially under variations of temperature. (c) The joints between metal, cement and porcelain were provided with elastic cushions. (d) Sharp corners in the porcelain were eliminated as far as possible in order to reduce possibilities for concentration of electric field. (e) The string was graded by varying the capacity of the units so as to make the voltage distribution as even as possible. (f) The cement was electrically short-circuited by means of a conducting film on the porcelain, which film was connected with a cap or pin. For later insulators the grading has been replaced by shielding accomplished by arcing horns of a special design.

2. That of these insulators 70,000 have been in operation during the past six or seven years without any aging phenomena. Fifteen or twenty units have been replaced on account of damage from arcs, otherwise no replacements have been necessary. Experience has shown that electrical phenomena in the cement are probably of little importance.

3. That experience from certain insulators has strongly brought out the detrimental effects of expanding cement.

H. V. Carpenter, Pullman, Wash., thought that while perhaps better porcelain is being produced, this better porcelain introduces some new characteristics which must be learned.

MEGGER NOT A CONCLUSIVE TEST

H. H. Schoolfield, Portland, Ore., recently tested a 66-kv. line with a Johnson "buzz stick," which was the first test the line had received since 1912, the date of installation. This line is near The Dalles, in a dry part of Oregon. About 3 per cent of the insulators were found bad by this method, which Mr. Schoolfield considered a good record for insulators bought in 1912. The line is somewhat underinsulated, there being three units in suspension strings and four units in strain strings. A large percentage of the failures took place at the point of support. Upon checking with a megger the insulators which failed under the "buzz stick" the results obtained indicated that the megger does not show all the bad insulators.

R. J. C. Wood was somewhat surprised at the temerity of Mr. Schoolfield in his use of the "buzz stick" under these conditions and mentioned his own electroscope testing apparatus, made from a Bakelite tube, which avoided the possibility of short-circuiting a string in case two insulators out of three were bad.

H. L. Melvin, Spokane, Wash., asserted that while the operating engineer was not a designer and while he depended upon the manufacturer for design and test, still the operator was at fault for not keeping an adequate record of failures from which more conclusive data could be obtained.

D. I. Cone, San Francisco, approaching the subject from a different angle, said that telephone engineers note with pleasure the increase in freedom from insulator failure and from the consequent telephone disturbance.

R. M. Boykin, Portland, Ore., wanted to know about the standard test for insulators which the executive committee of the N.E.L.A. Technical Section had requested from the A.I.E.E. standards committee. C. E. Skinner stated that no standard test had been reached and that one of the reasons was that new tests such as those suggested by Mr. Lapp were being introduced into the industry and were making it impracticable to reach any definite conclusion as to a standard.

Symposium on Electrical Precipitation

INVESTIGATIONS in regard to the electrical precipitation of solids from gases during recent years have resulted in some important conclusions, which were presented by Walter A. Schmidt in a paper entitled "Recent Conclusions Pertaining to Electrical Precipitation."

It was early recognized that percentage of precipitation increased as the voltage approached the arcing points, and that the electrical discharge or current flow increased simultaneously and in a more or less definitely related manner. Later, in certain commercial problems, however, the poorest results were obtained with the highest current flow, that is, with the most intense corona discharge, making it imperative that the subject should be investigated.

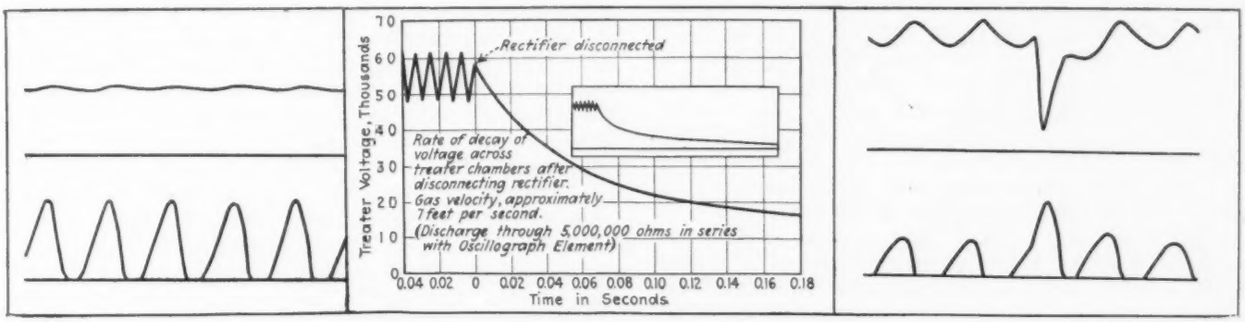
In practice a precipitator consists of a multiplicity of opposing electrode units, one group being of such shape as to facilitate corona discharge, the other group being of such form as to minimize or prevent discharge. The former are usually referred to as discharge electrodes, the latter as collecting electrodes. Discharge electrodes may consist of wire, chains, edged strips, serrated edges, or any other form of conductor that will establish a sufficiently high potential gradient at or near its surface to cause corona discharge. Collecting electrodes may consist of plates, pipes, screens, closely grouped wires, or any other form or arrangement of conductors that will establish low field concentration and thus minimize or prevent corona discharge. Usually the collecting electrode system is of much greater weight than the discharge electrode system and consequently is electrically grounded. The potential difference maintained between electrodes depends on the spacing and other circumstances and ranges in different installations from 20,000 volts to 100,000 volts. Unidirectional current is supplied by rectifying high-tension alternating current. The precipitator has received the name of treater, and the type of collecting electrodes designates the type of treater, as, for example, pipe, plate or screen treater.

When discharge is raised above the critical potential a corona discharge is established, the gas immediately

around the wire becomes ionized, and the resultant ions travel either to the collecting electrode or to the discharge electrode, depending on whether they are negative or positive. Should the gas in its tubes carry suspended liquid or solid particles, such as come within the zone of ionization, it may become either negatively or positively charged and thus be either repelled from or drawn to the discharge electrodes. Load particles which remain outside of the zone of ionization become negatively charged and are forced over to the collecting electrodes. In practice it is found that a certain amount of the precipitated material is always collected upon the discharge electrode, but by far the greater part is collected on the grounded collecting electrodes. As soon as material commences to collect on electrodes conditions in the precipitator change. The deposit forms a series of minute particles separated by equally minute gas pockets, and as the solid particles in the gas will have different dielectric properties the electric field will be concentrated at the points of contact or approximate contact of the solid particles. As the charge accumulated at the surface increases the field increases, and the parts of local concentration will rise to field intensity sufficient to cause ionization of the gas within the deposit. When this condition is established the deposit becomes an ionizer or source of discharge, with most disastrous results. This can be prevented by keeping the collecting electrode at all times conducting.

"The Electrical Precipitation of Solids from Smelter Gases" formed the title of a paper presented by Ross B. Rathbun. The author set forth the fundamental principles of a precipitation process as developed by Cottrell and described the various types of treaters in common use, showing that gas is ionized more efficiently for a given power consumption and the construction simplified and reduced by arranging the electrodes in a flue so that their dielectric fields are in series with each other. By this means the gas flow is parallel to the electrostatic lines instead of at right angles to them. The physical rather than the chemical structure of the dust in suspension is a very important item, and metallurgical factors which control the amount of sulphuric acid and water vapor in the gases also have an important bearing on the operation. Several theories were given regarding the fact that dust is much easier to precipitate than fume, and some photographs illustrated the difference in structure between the fume and dust. Selective absorption was given as an explanation of how aqueous vapor added to the gas stream functions to permit electric charge to leak through a dry precipitated coating to the electrode. The author also discussed the theory of back ionization and phenomena of discontinuous dielectric and pointed out that these electrical matters are secondary to treater design and the conditioning of the gases.

The "Electrical Enginering Features of the Electrical Precipitation Process" was the title of a paper by G. H. Horne in which he described in detail the common sources of power for precipitation work. In the commercial plant today the low-tension current is supplied to the transformer either through a synchronous motor or motor-generator, and the transformers are standardized at a voltage ratio of 220 or 440 to 100,000 volts, with taps in the low tension to give 50, 62½, 75, 87½ and 100 kv., the capacities being 10, 15 and 25 kva. As it is necessary to supply the discharge electrode system with unidirectional current to obtain maximum precipitation efficiency, a mechanical rectifier is used which consists of a bakelite disk to the periphery of which are attached two quadrant metal strips opposite each other, constituting the moving conductors. The four stationary shoes are so mounted that they may be rotated about the disk through 90 deg. by means of a hand wheel, pinion and gear segment. The length of the stationary shoes and the length of the moving conductors determine the length of contact on the wave, and the position of the shoes about the disk, as adjusted by the handwheel, determines the portion of the wave rectified. These mechanical rectifiers so far are the only type that have proved successful.


Rectifier disconnected
Rate of decay of voltage across treater chambers after disconnecting rectifier. Gas velocity, approximately 7 feet per second. (Discharge through 5,000,000 ohms in series with Oscillograph Element)
Treater Voltage, Thousands
Time in Seconds
70
60
50
40
30
20
10
0
0.04 0.02 0 0.02 0.04 0.06 0.08 0.10 0.12 0.14 0.16 0.18

ELECTRICAL CHARACTERISTICS OF TREATER CIRCUITS

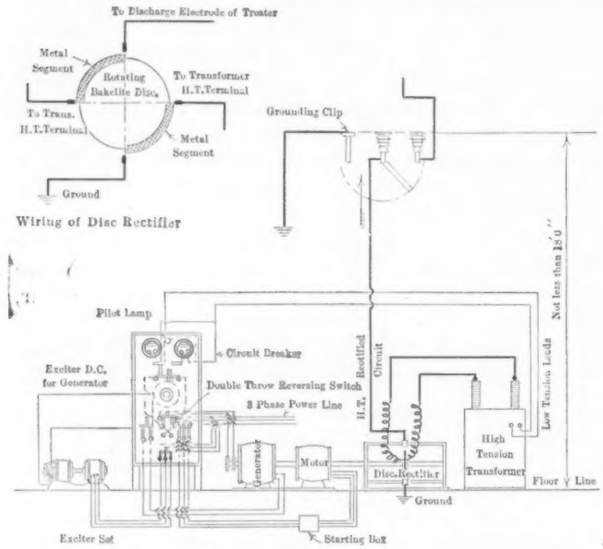
Left—Treater voltage with a peak of 57,000 and treater current of 1 amp. applied to a large unidirectional treater installation. Middle—The rate of treater discharge is slow as the result of low velocity of the charged particles. Right—Rapid recovery of treater voltage following breakdown between electrodes during the precipitation process.

The power consumption of a precipitator having clean electrodes and ordinary air as the dielectric medium appears to follow the laws of dielectric phenomena developed by F. W. Peck, Jr. On the other hand, the power consumption in a normally operating precipitator having the electrodes covered with deposits of fume or dust and having furnace gases as the dielectric is influenced by a number of factors which have not yet been fully investigated. Ionization of the gases and high

NEW VOLTAGE DATA ON DIFFERENT MATERIALS WHICH CAN BE PRECIPITATED

Material on Plate		Arcing Voltage, Kv. Peak
Plate clean	Point negative	120
Mica	Point negative	50
Sulphur	Point negative	50
Glass wool	Point negative	50
Varnished cambric	Point negative	70
Filter paper	Point negative	90
Writing paper	Point negative	118
Writing paper crumpled	Point negative	90
Edge of glass plate	Point negative	65
Asbestos	Point negative	100
Plate clean	Point positive	45

temperature also may cause variation over and above those which would be expected from the corresponding reduction in the gas density. The two curves shown indicate the power used by a pipe precipitator, one having air and the other mist-laden gas. The power for the air curve is greater than for the gas curve up to a voltage of approximately 60 kv., where the curves intersect. The general conclusion is that Peek's expression for



ELECTRICAL PRECIPITATION REQUIRES THE PRODUCTION OF A UNIDIRECTIONAL ELECTROSTATIC FIELD IN WHICH A CORONA DISCHARGE IS MAINTAINED

corona loss may be used, subject to correction, as a means of interpreting electrical precipitation power data.

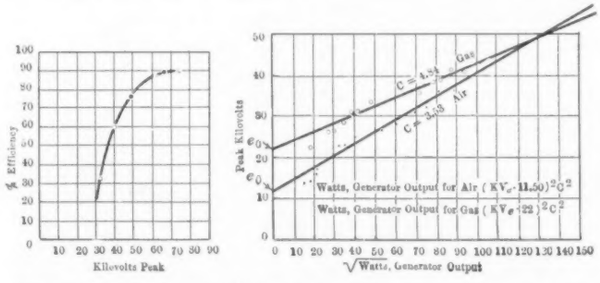
In presenting his paper Mr. Schmidt remarked that it was peculiar that this electrical precipitation process had not been developed by electrical engineers, but rather by chemists, electrophysicists and electrometallurgists. The art has advanced, however, until it is possible to treat as high as 2,000,000 cu.ft. to 3,000,000 cu.ft. of gas per second.

O. H. Eschholz, East Pittsburgh, Pa., in a written discussion, pointed out that electrostatic precipitation is actually the successful utilization of the corona phenomenon, which usually results in an energy waste or impending failure, but in this case is the essential operating agency. Because of the importance of the corona phenomenon involved, interest is frequently centered on the character of the treater voltage wave. In the three figures presented herewith, which were a part of Mr. Eschholz's discussion, he showed first an oscillograph record of treater voltage and currents. The peak voltage was 57,000, the effective voltage 97 per cent of the peak. The effective mechanical rectifier ground current was approximately 1 amp. This quite flat character of the voltage wave is doubtless responsible for Mr. Horne's observation that the substitution of a high-voltage direct-current generator (Girven) for the mechanical rectifier does not give a substantial increase in precipitation of frequency.

With reference to the low velocity of the heavy ions, Fig. 2 shows the comparatively slow rate of treater discharge upon disconnecting the supply circuit as a result of this low ion velocity. As a result of the low ionic drift, considerable energy is stored between electrodes. This is useful in maintaining treater voltage or serves quickly to re-establish such voltage in the event of a short circuit caused by breakdown between electrodes. This latter effect is well illustrated in the unusual record shown in Fig. 3. This shows the treater voltage and current before, during and after a breakdown between treater electrodes. Only those particles in the immediate path of the arc were discharged, thus permitting the immediate re-establishment of treater voltage when the arc had been ruptured at the contacts of the rectifier. It is important to note that because of this low ionic drift and the breaker-like action of the mechanical rectifier, the precipitation time lost due to treater short circuits is negligible, and hence it is practicable to operate treaters very close to their critical breakdown voltage. Mr. Eschholz also pointed out that treater circuits may serve as a source of high-frequency radiation and hence cause wireless interference. Apparently the energy stored in the treater proper is radiated from the transmission line at the latter's natural frequency.

E. P. Dillon, New York, also in a written discussion, said that lack of knowledge of the phenomena now explained by Mr. Schmidt had for many years been an obstacle to precipitation engineers in their efforts successfully to handle certain kinds and conditions of gases that do not lend themselves readily to effective clean-up in Cottrell precipitation treaters. Mr. Dillon also voiced his keen appreciation of the excellence and value of the Anderson and Horne work, which has established mathematically very important conclusions with reference to precipitation phenomena. The result of this is that engineers are now better equipped to design treaters for practically any problem of cleaning gas and to predetermine the percentage of recovery or clean-up. In other words, engineers are now equipped with information permitting them to take cognizance of the economic elements in designing a treater for a given problem.

J. C. Hale, New York, said in a written discussion that the relative advantages of the synchronous motor and the motor-generator set depend largely upon the characteristics of the power supply circuit to which they



LEFT—THE PRECIPITATION EFFICIENCY DOES NOT INCREASE INDEFINITELY WITH THE PEAK KILOVOLTS. RIGHT—UP TO ABOUT 50 KV. THE POWER REQUIRED FOR PRECIPITATION IN AIR EXCEEDS THAT FOR MIST-LADEN GASES

are to be connected. With poor regulation on this circuit the motor generator is perhaps better; however, sufficiently close voltage regulation to permit satisfactory operation of synchronous motors is usually found. Another disadvantage of the motor-generator is the voltage distortion from a 5-kva. or even a 15-kva. generator due to oscillations from the rectifier circuit. These could not occur on a large system as the oscilla-

tions would be too small to react. What the effects of these are is not yet definitely known.

Mr. Dillon also complimented Mr. Rathbun for his development of the wire-type treater, and Mr. Schmidt and C. N. Beebe, Vancouver, both called attention to the fact that the Rathbun treater requires a smaller cubical volume, Mr. Schmidt further pointing out that in order to get the greater precipitation in the same cubical volume, a much greater length of discharge electrode is used by Mr. Rathbun, but that the Anderson-Horne law still holds.

From the economic standpoint, Mr. Beebe asserted that modern smelting companies do not hesitate to spend a million dollars if necessary on precipitation installations and that the Rathbun research had done much to keep such figures low.

Education Attracts Attention

IN THE United States today empirical, shop and laboratory practices in educational institutions, from the kindergarten to the university, are overdone. This is the opinion of Taliaferro Milton as expressed in a paper entitled "Training to Think Versus Gathering Information." The author averred his belief that there should be no fundamental difference between the general methods of engineering education and education in any other profession. The chief element of education is to teach the student to think and give him just such facts as are necessary to make him think. One of the main troubles with modern colleges, especially the large one, is the lack of democratic spirit. As a result of observations throughout the country Mr. Milton concluded that graduates from the smaller colleges are more democratic in spirit because their time is not so largely spent on other things than college work.

The colleges of the country should change their courses and take cognizance of the fact that industry today needs men who will take charge of the business side of the work, L. A. Ferguson declared in his paper on "Engineering Graduates in Business." The training of the students of the future, said Mr. Ferguson, should make provision for the type of men who, though they may not shine in technical work, will nevertheless take places of importance in the industrial world, where leadership, salesmanship and executive ability are in great demand.

COLLEGES RUN INEFFICIENTLY

There is a very great waste of good material in the educational institutions of this country, in the opinion of J. W. Upp, who presented a paper entitled "Conservation or Waste of Material in Educational Institutions." Mr. Upp compared the colleges with an up-to-date business institution and said that such a loss of material as occurred in colleges would never be countenanced by any progressive business. He thought that a college or university should be run according to the best modern business principles; that is, the administrator should be able to show a satisfactory return on the investment. In his opinion the number of students who have failed to complete their work or who have dropped out of college is the best criterion regarding the college's efficiency as an educational institution.

The selecting and training of teachers is probably the most important phase of college administration, and teaching calls for leaders of the highest type, who should be properly remunerated and properly trained.

E. E. F. Creighton in opening the discussion on the educational papers said that this was a continuation of the educational symposium started as a result of the educational committee's activities during the past two years and that the principal purpose of the committee's survey and of this symposium was really to get the engineer in practice interested in what the university is doing so that he will assist the university to produce the right sort of material. Referring to the older engineering manufacturing organizations, Mr. Creighton said that the chief engineer knew all of the organization's engineers, assistants and foremen and even most of the workers and really was the czar in the organization. Salesmen then were untechnical and under the thumb of the engineer. Finally, however, the management realized that salesmen must not be mere gingham-counter clerks, and salaried places as salesmen were offered to technical graduates until the pendulum swung to the point where salesmen came to speak of "our engineers."

C. E. Magnusson, Seattle, said that whether it appreciates the university output or not, the profession cannot get along without the university. As to selection of material entering the university, Professor Magnusson said he would like to see the man who can go to the high school and pick out the executives of twenty years hence. While psychologists can help, Professor Magnusson pointed to a nationally advertised psychological wonder who is now in his classes and for whom the professor is trying to find a means of earning his bread and butter. Referring to Mr. Ferguson's analogy with the pine and the maple, Professor Magnusson wondered if possibly the result of trying to segregate the maple would not be to produce a bird's-eye maple, more decorative than useful.

Since this discussion was a continuation of the discussion at Niagara Falls, Professor Magnusson referred to Mr. Doane's paper and said that although universities would welcome the placing of instructors in industries for a year, they would welcome even more the absorption of engineers from industry into university work for a year at a time. If he could have only one or two such per year, "they would come out different men" with reference to their attitude toward universities.

William McClellan, New York, said that of course men must be trained as citizens and engineers as engineers and that the two things must not be confused. A man to design a bridge must be familiar with all kinds of reinforced concrete, all kinds of structural steel, all types of bridges, he must be up to date on all recent bridges built, on technical ways of doing things, etc. If he has taken the time to keep up on all this, can be also have the time to be a business man and a lawyer as well? Naturally he must broaden in order to take his place as a citizen in his club circle and in his talks with other men, but even if he does not he may still be a big engineer.

F. D. Weber, Portland, Ore., a member of the Oregon Rating Board for the Registration of Engineers in Oregon, said he thought useful information could be obtained from the records of the various boards operating under the new licensing laws in different states. In Oregon, with a population of something like 700,000, 1,240 have registered as professional engineers. In the examination of these men the most striking characteris-

tic is the lack of ability to attack new problems out of the line of the specialty of the man in question.

Professor Matthewson of the department of civil engineering, University of British Columbia, discussing the relation of the university to the engineering profession said that it must not be forgotten that all so-called self-educated engineers actually draw upon university work or its equivalent or they would not be successful.

J. B. Fisken, Spokane, Wash., referred, as did many others, to the insufficient emolument of university professors as limiting the supply of high-grade men for the training of future engineers.

Walter A. Schmidt, Los Angeles, said he thought that an attempt was being made to make "super-engineers" in numbers out of harmony with the possibility.

W. A. Hillebrand said that there are perhaps thirty qualifications necessary to success. Of these a college has a contact with not more than two or three, and this ought to be made clear to college students. A college can train men to think but it can have an effect only upon those who will submit to the training.

Miscellaneous Papers

INSTABILITY as applied to an exciter has many meanings, including any change in voltage for a small change in load, a creeping of the voltage without apparent cause, temporary loss or reversal of excitation accompanying sudden short circuit of the alternator, and grabbing of the load when in parallel with other exciters. R. E. Doherty, in a paper entitled "Exciter Instability," held that experience has shown that most of these phenomena occur when the exciter is operating at low magnetic densities. The author made a study of circuits, assuming the exciter to be operating within the range of the straight portion of the saturation curve, and checked the results by an experimental study. He concluded that the conditions of instability are low magnetic densities in combination with one or more other things, such as low residual voltage, a large drop in the armature, a relatively large inductance in the load circuit, and alternator transient of greater duration than exciter transient, or excessive series field strength. His conclusions were based on an equation which is the same form as that given for an electric circuit containing resistance, inductance and capacity, the only difference being that the duration of oscillations and transients is much longer. Mr. Doherty said that an exciter can be stabilized against voltage creeping by special design, or by the use of a few batteries connected in series with shunt field, or by using automatic regulators or rheostats in the alternator field.

R. J. C. Wood, Los Angeles, said that Mr. Doherty's paper was a good argument for the directly connected exciter on the generator shaft. This, of course, is the direction in which the industry is going, but from the standpoint of stability it is possible and easier to design a directly connected exciter so as to avoid operation on a low saturation point of the curve. J. Brown, however, pointed out that when a voltage regulator is used and a broad range needed, it is necessary to operate low on a saturation curve. Some of the points made by Mr. Doherty, he said, mean that more attention must be paid to the application of exciters.

O. C. Merril's paper was presented by G. F. Brown of Schenectady, but called forth no discussion.

Colorado and power development on the Colorado River have attracted the attention of hydraulic engineers very much during the last year, and a paper was prepared on this subject by O. C. Merrill.

PICTURE TELEGRAPHY

Picture telegraphy is as yet far from the zenith of its possibilities, in the opinion of D. W. Isakson, who presented a paper entitled "Developments in telephotography." The art of transmitting an optical image to a distance by means of an electric circuit has beginnings which reach back more than seventy years, but as yet it has had no results which warrant its commercial application. The problem has been discussed and worked on by modern scientists, such as Korn and Belin, and in addition the Leishman systems have been developed, all along lines leading to ultimate solution. A broad field for investigation and experimentation in the application of new and untried laws and the phenomena of physics, chemistry and electricity is unfolded to the engineer in developing this phase of engineering. Mr. Isakson anticipated a great advance in the art during the next decade.

The only discussion on Mr. Isakson's paper, which was conceded to give a clear exposition of modern developments in this line, was to question the term used. "Telephotography" has long been used as a term in the photographic arts to indicate a photograph of a distant object taken through a telescope or "telephoto" lens to make it appear as if the picture were taken at close hand. Some other term should be adopted by electrical science to indicate the transmission of pictures by telegraph or telephone or radio.

Miscellaneous Features

ON TUESDAY evening G. Faccioli entertained the convention delegates with an interesting, informal illustrated discussion on the reduction of engineering problems to their simple elements. This talk was filled with examples pertinent to the discussion.

On Thursday evening R. J. C. Wood, Los Angeles, and Joseph Mini, Jr., San Francisco, gave extended talks illustrated by stereopticon describing graphically developments and plants of the Southern California Edison Company and the Pacific Gas & Electric Company.

On Thursday afternoon C. E. Skinner, East Pittsburgh, Pa., addressed the convention on the present status of standardization both in America and internationally, showing the development of the American Engineering Standards Committee. He also gave an illustrated talk on the new 1,000,000-volt testing laboratory of the Westinghouse company at East Pittsburgh.

On the same afternoon Lieut.-Commander A. M. Charlton, U. S. S. *Tennessee*, gave a complete description of the electrical equipment of the *Tennessee*, which was visited by several of the convention delegates on Saturday, Aug. 12, at Bellingham.

On Friday afternoon all of the delegates and guests were entertained by the British Columbia Electric Railway Company, Ltd., going by boat to Lake Buntzen for a complete inspection of the two hydro-electric plants of the company at that place.

The location of the next Pacific Coast convention was left undetermined, with the probability that it will be held in San Francisco in August, 1923.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Conductivity of Creosoted Poles

To the Editors of the Electrical World:

On page 674 of the June 12 issue of *Commerce Reports* is an interesting article, "Creosoted Poles Used in Southern France." The methods of treatment used in France and the durability obtained cannot be compared with the standards in use in the United States, where a greater penetration of the preservative and hence longer service are secured; but the statement about the electrical resistance is of interest.

Accompanying this letter is a copy of the statement to which I have just made reference. This may be of especial value at this time to the readers of the *Electrical World* on account of the increased use of pressure-creosoted pine poles. The results of these experiments on conductivity of creosoted poles compare very favorably with the results of tests made in this country on the relative conductivity of treated and untreated ties.

P. R. HICKS,
Secretary-Manager.

Service Bureau American Wood Preservers' Association,
Chicago, Ill.

[The inclosure referred to by Mr. Hicks follows:

Recent experiments conducted by the faculty of science of the University of Toulouse, in co-operation with the Société Méridionale de Transport de Force of Carcassonne, indicate that creosoted poles have a much lower conductivity than ordinary wooden poles. It appears that there is only about one-fourth the loss of electrical energy through creosoted poles which occurs through uncreosoted poles. It cannot be claimed that the former are non-conductors, but their conductivity is so low that on certain lines the transmission wires have been affixed directly to them without the use of insulators, with results quite satisfactory during dry weather, so long as the periods of transmission were confined to actual working hours.]

Heat-Recovery Apparatus in the Gennevilliers Power Station

To the Editors of the Electrical World:

I have just read with a great deal of interest the article appearing in the *Electrical World* describing the Gennevilliers power station near Paris.

The principal feature which stands out in this station is the application of practically every form of heat-recovery apparatus which has been developed up to the present time. This, of course, may be warranted by the price of coal existing in France. However, it has occurred to me that if high-grade English coal can be delivered to the United States at a price not very much higher than our own coal, the price of coal in France is not so excessive. In other words, I question the use of some of the heat-recovery equipment in this station in face of the fact that in this country, for instance, there seems to be a diversity of opinion as to the use of economizers. For example, economizers were not installed in the Hell Gate power station of the United Electric Light & Power Company of New York City.

The most radical departure in the Gennevilliers station is the use of air heaters in addition to economizers. In reviewing the history of various heat-recovery apparatus I cannot help wondering whether or not air heaters will not go through a temporary wave of popularity.

I think the operators of the Gennevilliers power station can render a great service to the engineering world if they subject this station and its individual equipment to exhaustive tests and publish the information thus obtained. If this is done, engineers will be in a better position to judge whether or not air preheaters, for instance, are desirable for a particular station.

Another feature which stands out is the position of the superheaters. It will be noticed that they are apparently entirely outside the boiler setting and receive the gases after they have passed through not only the first pass but the circulating tubes as well. This is contrary to practice in this country, where the tendency is to place the superheaters as near the fire as possible. With the superheaters installed as in the Paris station, an area of approximately 50 per cent of the boiler-heating surface is required in order to obtain a superheat of 250 deg.

An interesting feature is the fact that the amount of surface employed in the various heat recovery apparatus is more than twice that in the boilers proper.

Another outstanding feature in this station is the simplicity of the turbines, which employ only ten stages as compared with the twenty stages used in this country for the same size of unit. The economy of these units is also very much better than that obtained in this country, the water rate being about 10 per cent lower than the best water rate obtained in the United States, after correcting for difference in steam conditions.

Among other features the actual performance of which will be of great interest are the generator air coolers and the Venturi stacks.

HERBERT B. REYNOLDS,
New York, N. Y. Consulting Mechanical Engineer.

"A Question of Copper"

To the Editors of the Electrical World:

The letter of L. H. B. Sandwell appearing in the July 29 issue of the *Electrical World* seems to me to be in error. The statement with regard to transformers that a 220-volt secondary would require less copper than a 110-volt secondary is, of course, wrong. A 220-volt secondary transformer requires just half the cross-section and double the turns of copper, which results in slightly more copper for 220 volts than for 110 volts. It would seem to me that the same thing would apply to rotaries, motors, etc., although I am not so familiar with other apparatus as with transformers. In addition, the smaller wire costs more than does the larger wire.

Regarding lamps Mr. Sandwell admits that these would be more expensive on account of the shorter life. There is no doubt that the troubles with short circuits and the destruction of heating devices would be far greater, and the burning out of small motors would also be increased.

Another distinct disadvantage would be that shocks to customers would be more frequent and more perceptible to them.

In short, I think that the only saving in using 220 volts would be on the secondary network, and it hardly seems likely that this saving would be enough to offset the disadvantages.

R. V. BINGAY.
Pittsburgh Transformer Company, Pittsburgh, Pa.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Rugged Dead-End Assembly for 1,700-Ft. Span

FOR dead-ending a long 63,000-volt transmission span an assembly consisting of four strings of insulators fastened to steel seats in the manner shown in the accompanying illustration is used at the High Bridge substation of the Northern States Power Company at St. Paul. Steel towers, 125 ft. high, form the supports for the 1,700-ft. span over the Mississippi River at this point, one of the towers being used as the framework of a 3,000-kva. outdoor substation. This substation, with a photograph of the tower, was described on page 136 of the Jan. 21 issue of the *Electrical World*.

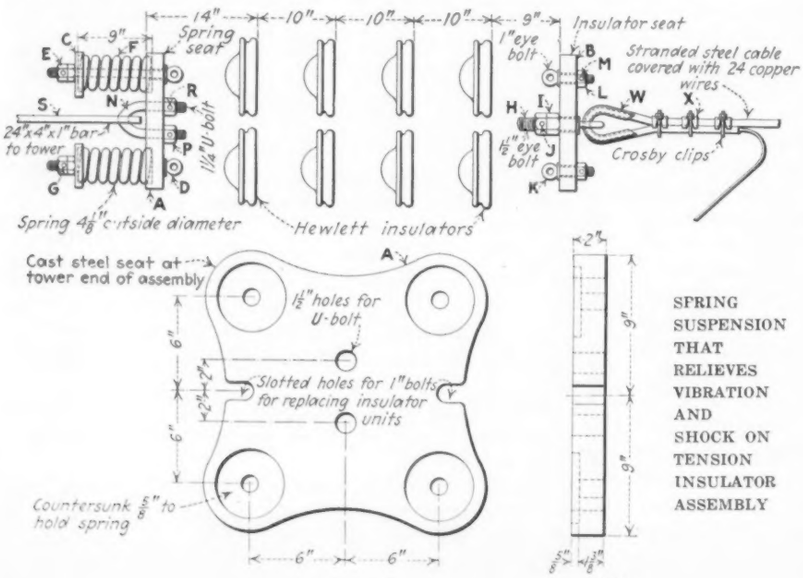
A feature of the insulator assembly is the springs, normally under compression, which are designed to protect the insulators from the effects of vibration or shock. There are four insulator strings, and in place of the usual yoke and equalizer arrangement, a cast-steel plate is used, a spring being provided at the tower end for each insulator string while eye-bolts only are used at the other end. The plates are notched on opposite sides so that bolts can be inserted and the nuts drawn up to release the tension and allow the removal of one or all of the insulator strings for maintenance purposes.

The tension on the insulator strings in each assembly is equalized by tightening or loosening the nuts on the end of the eye-bolts running through the springs. Minor adjustments of sag in each conductor can be made by use of the closely spaced holes in the bar which connects the assembly to the tower.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

MATERIAL REQUIRED FOR ASSEMBLY OF ONE DEAD-END

Material	Index to Chart
One cast-steel seat, tower end	A
One cast-steel seat, line end	B
Four spring caps	C
Four 1-in. eye-bolts	D
Eight hexagon nuts for 1-in. bolts	E
Four springs	F
Four ¾-in. split cotter pins	G
One 1⅛-in. eye-bolt	H
Two hexagon nuts for 1⅛-in. bolts	I
One ¼-in. split cotter pin	J
Four 1-in. eye-bolts	K
Four hexagon nuts for 1-in. bolts	L
Four ¼-in. split cotter pins	M
One 1¼-in. U-bolt	N
Two hexagon nuts for 1¼-in. bolts	P
Two ¼-in. split cotter pins	R
One 4-in. x 1-in. bar	S
One 1⅛-in. bolt	T
One hexagon nut for 1⅛-in. bolt	U
One ¼-in. split cotter pin	V
One ⅝-in. thimble for ⅝-in. cable	W
Three ⅝-in. Crosby clips	X
Six 1-in. x 5-ft. 6-in. rods	Y
Six hexagon nuts for 1-in. rods	Z
Six washers for 1-in. rods	A-A



SPRING SUSPENSION THAT RELIEVES VIBRATION AND SHOCK ON TENSION INSULATOR ASSEMBLY

Auxiliaries of 2,300-Volt Rating Reduce Losses

RELIABILITY, flexibility and simplicity are the underlying requirements for station auxiliary drive. The outstanding features of the increasing use of electrically driven auxiliaries have been the extensive application of the alternating-current motor, and particularly the use of 2,300-volt motors in sizes of 50 hp. and above. Direct current was used in many plants in the past for those auxiliaries which were motor-driven, but, as in the industrial field, the improvement in alternating-current motors has led to their general adoption for station auxiliaries also, the remaining exception of importance in most cases being the drive for stokers.

The distribution of either alternating current or direct current at voltages of 600 and below for the auxiliaries in a large plant involves very great investment and heavy losses and is decidedly uneconomical when compared with the distribution where a considerable portion of the load consists of 2,300-volt motors driving the larger auxiliaries. In most of the stations of large capacity built within the last few years 2,300-volt motors are being used quite extensively with entire satisfaction. In the selection of such motors and their control equipment, however, it is important to be assured of ruggedness of construction, ample clearances and simplicity of operation. An indication of the general trend which is of particular interest is that of the Hell Gate station in New York r cently placed in operation. In this station all auxiliaries, with the exception of two or three steam reserves, such as emergency boiler-feed pumps, etc., are electrically driven. Moreover, all of the auxiliary motors are alternating current, with all motors above 25 hp. operating on 2,300 volts.

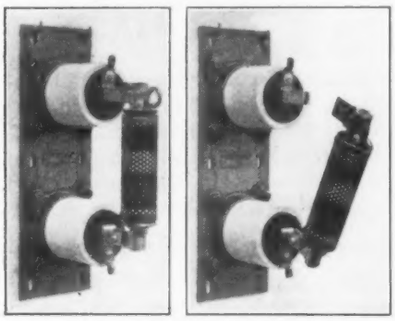
A noteworthy record is the use for the first time in large generat-

ing stations of the truck-type switchboard equipment in connection with the 2,300-volt supply to station auxiliary motors in both the Hell Gate station and the South Meadow station in Hartford, Conn.

H. C. ALBRECHT,
Electrical Engineer.
Philadelphia Electric Company,
Philadelphia, Pa.

Protective Resistor Also Disconnects

POTENTIAL taps from circuits operating at 6,600 volts and above, such as those for potential-transformer primaries and ground-detector leads, have in many instances been



RESISTOR SWITCH USED TO PROTECT POTENTIAL TRANSFORMERS, ETC.

insufficiently safeguarded against failure of potential fuses to clear the circuit in case of breakdown of equipment. The potential fuses in such cases are called upon to open short-circuit currents many times in excess of their rating, with consequent danger of serious damage to equipment and to the service.

Resistors mounted on porcelain supports and ranging in value from 200 ohms to 500 ohms have in recent installations been inserted in potential leads as close to the point of tapping the main circuit as possible. These resistors have the effect of limiting short-circuit currents to values well within the rupturing ability of the fuses.

Such resistors, with an additional disconnecting feature, were recently installed in a new plant extension for the Queens Borough Gas & Electric Company, at Far Rockaway, Long Island, N. Y. The resistors, as shown in the accompanying illustration, are mounted on porcelain supports and are hinged to provide the disconnecting feature, thus combining the functions of a current-limiting resistor with those of a disconnecting switch. The opening of this device by means of the usual switch-hook makes it certain that the entire fuse mounting, wiring and potential equipment is dead and eliminates the necessity of having to replace or remove potential fuses with special tongs. More important still, it reduces the likelihood of an operator attempting to remove a live fuse by hand because the special tongs are not available at the moment. The illustration shows this equipment as designed for 15,000-volt service.

Similar disconnecting resistors were also used in a recent installation for the Potomac Electric Power Company, Washington, D. C.

C. A. CORNEY,
Electrical Engineer.
Stone & Webster, Inc.,
Boston, Mass.

Furnace Characteristics Determine Economy

AMONG the several factors that determine the choice of an electric furnace for the melting of brass are ability to produce a high-grade metal, good flexibility, simplicity of operation, high thermal efficiency, low renewal and repair cost and good power characteristics. All these have a vital effect on the cost per ton of castings. It may be a simple matter to increase the thermal efficiency of a furnace, but it sometimes can only be done at the expense of good power characteristics, life of furnace linings, adaptability to handle a wide range of alloys and the quality of metal produced. A low power consumption per ton may be meaningless, since the load factor may be so low that the rate per kilowatt-hour would be high, and the power cost per ton may be greater than in a furnace having a low thermal efficiency and consuming more kilowatt-hours but at a good load factor. In this latter case the rate per kilowatt-hour would be low and the cost per ton would also be lower than in the case of a furnace with a high thermal efficiency. Furnace design at best is a compromise.

Comparing the characteristics of the three different types of furnaces now in use—namely, the induction, arc and resistance types—various principles are seen to be utilized in their design and method of operation. If the induction furnace is so designed that the metal itself forms the secondary of a transformer, a high thermal efficiency results, so that the power consumption per ton of metal melted is lower than in any other type. The accompanying table shows that the average monthly load factor ranges from 70 per cent to 75 per cent when operating twenty-four hours per day. For a 60-kw. furnace with a capacity of 600 lb. the average power factor is between 65 per cent and 75 per cent. Some objections to this furnace are that both high-zinc and low-zinc alloys cannot be handled in the same furnace and that it must be preheated to start operation.

The arc type produces its heat from two electrodes placed in a cylindrical shell and then rocked with these electrodes as axes. The thermal efficiency is high, but not so high as the induction type, and the power consumption is low. A wide variety of alloys can be melted. The load factor is the lowest of the group, being 55 per cent with twenty-four-hour operation. With reactance to prevent surges, the power factor on the transformer primary may be as high as 80 per cent.

Resistance furnaces use as a heating medium a resistor material of crushed carbon placed in trenches of refractory material. The heat thus generated is radiated from the trench to the walls of the furnace. The power input is controlled by raising or lowering the electrodes embedded in the resistor material. From a metallurgical standpoint the supply of low temperature makes this furnace the best for melting high-zinc alloys, since the furnace atmosphere is non-oxidizing.

R. F. BENZINGER.
Electric Furnace Company,
Salem, Ohio.

CHARACTERISTICS OF VARIOUS FURNACE TYPES FOR MELTING BRASS

Type	Induction	Arc	Resistance
Monthly load factor:			
24-hour day, per cent	70–75	55	85
8-hour day, per cent	34	24	54
Average power factor, per cent	65–75	80	95–97
Capacity	60-90 kw., single-phase	300 kw., single-phase	100 kw., 1-2-3-phase
Thermal efficiency	High	High	Lower than other types
Alloys melted	Unsuited for high or low zinc alloys	Good for wide variety	Good for high zinc alloys
Operating difficulties	Must be preheated to start; requires molten metal to operate; must run continuously	Breakage of electrodes requires skilled operators	

Multiple Street Lighting Favored

Advantages and Economies of Multiple System Over Series Circuits Analyzed—Overhead Feeders Along Rear Lot Lines Supply Underground Cables to Lamp Standards

A REDUCTION in the length and a great saving in the cost of circuits were effected by the adoption of a multiple underground street-lighting system in East Cleveland* instead of the standard underground series system along the curb lines. Additional advantages of this system are that special series regulating transformers, panelboards, cut-outs and individual insulating transformers are unnecessary. The system is entirely safe in operation and, furthermore, additions to the system or changes in lamp sizes can be made without the limitations involved in a series circuit.

Another feature of the East Cleveland system is the current supply to residence street lamps, approximately 600 in number and of 150-watt size, from the 115-volt house-lighting secondaries through underground service brought out along the side lot lines. As indicated in Fig. 1, the multiple feeder lines and secondaries of the alternating-current house-lighting distribution system are carried on poles installed along the rear lot lines. Therefore, with a few exceptions, there are no pole lines installed along the residence streets.

An analysis of the cost of installing standard series circuits underground along the curb to supply the lamps on residence streets showed that the cost of this construction would run the expenditure for the system considerably beyond the limit of $90,000 provided in the bond issue to cover the cost of the system. The underground multiple system which was installed, owing to the fact that there were no wooden pole-lines on the streets and therefore a complete new series distribution would have been necessary, did not greatly exceed in cost the estimated expense of a standard overhead series system. The average expenditure of the city for the multiple-lamp standards installed, including underground work and time switches, was $131.53.

With the series system the minimum underground run along the street between lamps would have been 200 ft. This would have involved the crossing of many concrete automobile driveways and the tearing up of pavement to reach the lamps of the staggered system. The alternative, to avoid the opening of street pavements, would have been to run the full 400 ft. between lamps on the same side of the street. The multiple system showed an estimated average run of 130 ft. between the rear lot line and a lamp post at the curb. As actually installed, the average run per lamp was approximately 150 ft. The increase over the estimated run was due to runs along the curb to bring the lamps at exactly equal spacing distances.

The efficiency in lumens per watt of the series lamp is, of course, appreciably greater than that of the 115-volt multiple in the smaller lamp sizes. However, this difference is only about 10 per cent in lamps of the light output used in the East Cleveland system.

SPECIAL CIRCUITS UNNECESSARY

With the multiple system it was unnecessary to carry special circuits back to the power substation. On the other hand, of course, a switching arrangement was required. Several plans for switching the lamps were proposed and considered.† Time switches were adopted, arranged so that one time switch controls the lamps supplied by the secondary in one block, as shown in Fig. 1. Experimental work is still being carried on, and it is believed that in the future some form of remote-control switch which requires neither periodic setting nor a control wire will be adopted.

The details of a typical multiple underground lamp supply are shown in Fig. 2. The supply wire consists of a two-conductor construction with $\frac{3}{64}$-in. rubber, single-braid cover and $\frac{3}{64}$-in. lead sheath. The underground duct is of 2-in. fiber, placed at a depth of 18 in. to 24 in. below the surface. This duct is in 5-ft. lengths, and each joint is sealed with a collar of Portland cement. At the lamp standard a curved section of duct is used which leads into the base of the pole above the surface of the ground.

The first cost of the lead-wire fiber-duct installation was determined to be slightly greater than the cost of a low-voltage armored cable laid directly in the ground. How-

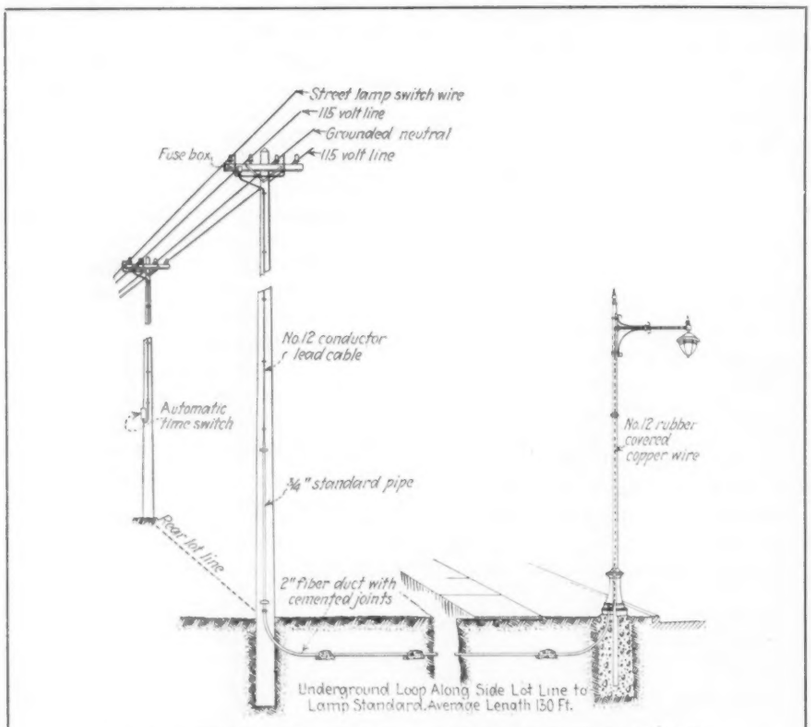

Street lamp switch wire
115 volt line
Grounded neutral
115 volt line
Fuse box
No.12 conductor lead cable
Automatic time switch
¾" standard pipe
Rear lot line
2" fiber duct with cemented joints
No.12 rubber covered copper wire
Underground Loop Along Side Lot Line to Lamp Standard-Average Length 130 Ft.

FIG. 1—TYPICAL ARRANGEMENTS OF MULTIPLE STREET-LIGHTING CIRCUITS IN RESIDENCE SECTION

*The considerations that led up to the adoption of this system were published on page 221 of the July 29 issue of the *Electrical World*.

†"Multiple Systems of Distribution for Street Lighting," Ward Harrison, *Transactions A. I. E. E.*, 1920.

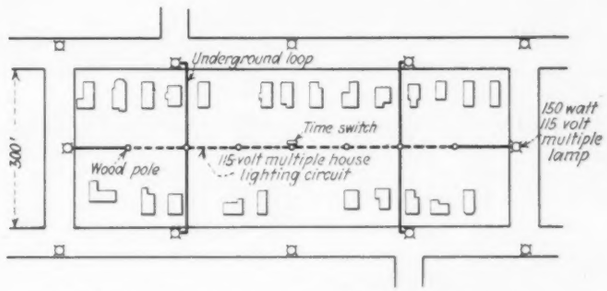


FIG. 2—METHOD OF SUPPLYING UNDERGROUND SERVICE TO STREET LAMPS FROM REAR-LOT-LINE OVERHEAD CIRCUITS

ever, since each individual underground lamp service is brought out along the side lot line through private property by virtue of an easement granted without cost to the city, the fiber-duct installation was chosen because it was considered that should a failure of the wire occur less disturbance in locating and remedying the fault would be involved than in the case of cable without duct laid in the ground. Experimental installations using the same lead-covered wire and other inexpensive types of wire and cable laid directly in the ground are being tried out in the system.

On certain thoroughfares series lines had previously been installed to supply the old arc lamps, and on Euclid Avenue in particular the series circuit was already carried in an underground-duct system. It was obviously a matter of economy to retain the series circuits which were already in place, and this was done. An individual insulating series transformer was installed for each of these series lamps so that low-tension leads only are carried into the lamp standards. In the case of Euclid Avenue individual transformers for the 1,000-cp. lamps were not placed in the base of the post according to usual practice, as the pole base did not provide sufficient space. Instead the transformers were grouped in the manholes of the duct system and the secondaries of the individual transformers were branched from these manholes to the nearby lamp standards.

EARL A. ANDERSON,
O. F. HAAS,
National Lamp Works, General Electric Co. Illuminating Engrs., Engineering Dept.
Nela Park, Cleveland, Ohio.

Changing Waterwheel Runner Increases Efficiency

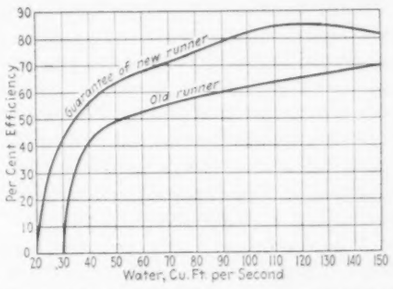
AN INTERESTING case of altering a waterwheel in a simple manner so as to improve its efficiency greatly is to be found in power house No. 2 of the San Joaquin Light & Power Corporation. This plant is near North Fork, Cal., and was completed in 1918. The equipment was chosen and purchased by a construction and engineering company two years before work was actually begun, and the waterwheel was consequently of a rather early design. The plant contains one unit, a 3,000-kva. generator, 35 deg. C. rise, directly connected to a 5,250-hp. reaction turbine opeating at 275 ft. head. The maximum efficiency of the turbine was at 132 cu.ft. per second, when it was guaranteed to develop 3,675 hp.

This unit might have been satisfactory if a large quantity of water, nearly the capacity of the wheel, had been available at all times; but the plant discharges from its tailrace directly into the conduit of another plant below. This conduit is also supplied with water from the South Fork of the North Fork of the San Joaquin River. The flow of this particular stream is not regulated by storage and so varies over a large range during the different seasons of the year. The water used by power house No. 2 comes from the Crane Valley Reservoir, of the San Joaquin Light & Power Corporation, with a capacity of 45,000 acre-ft.

The plant in operation gave very poor efficiency because there was not enough water available to load the waterwheel up to a point where any reasonable efficiency was to be obtained, and for a large portion of the time such low quantities were passed through that even the generator was operating at low efficiencies.

The matter was taken up with the different waterwheel manufacturers and their recommendations were obtained. One suggested a new runner designed according to latest practice and for capacities of water up to 150 cu.ft. per second only, as specified by San Joaquin Light & Power Corporation engineers, and the addition of liner plates and new wicket gates to the turbine. The maker of the wheel, however, proposed only a new runner of late design and high efficiency to fit the hub of the original one, with no liners or changes to the gates. The latter was much the cheaper proposition and was considered better also because the efficiency seemed higher. The accompanying curves show the over-all plant efficiencies based on generator and waterwheel manufacturers' guarantees.

The operation after the change seems very closely to substantiate the estimated figures. The discharge of 109 cu.ft. per second on the old runner gave 1,700 kw. output for the plant. With the new runner 2,100 kw. is obtained from the same quantity of water. The turbine operates much more quietly and at 140 cu.ft. per second delivers 2,600 kw. on the switchboard.



EFFICIENCY INCREASED BY SUBSTITUTING MODERN RUNNER FOR OLD

The entire work of making the change, including the cost of the new runner, was slightly under $3,000, and, as noted above, an increase of about 400 kw. in capacity has been obtained at the higher loads. Under normal operation the plant will deliver slightly more than 1,000,000 kw.-hr. per year over and above its original capacity.

L. J. MOORE,
Executive Engineer.
San Joaquin Light & Power Company,
Fresno, Cal.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

A Sales Force for a Scattered Territory

How a Central-Station Handles Its Commercial Organization and Regulates Stock to Produce Best Returns

By W. E. Prosser
Sales Department Adirondack Power & Light Corporation, Amsterdam, N. Y.

IN THE present stage of development in the electrical industry the central-station company has little or no reason to sell merchandise at cut prices. On the other hand, it has not been found good policy for companies to retire absolutely from the merchandising business. The electric light and power company enjoys a certain advantage over other merchants in that almost every one of its customers must come in contact with it at least once a month, and this offers the central station an excellent opportunity to provide an additional service to its customers in supplying them with standard appliances and at the same time earn a profit from their sale.

The most serious problem that confronts the company with regard to merchandising is how best to organize and conduct a sales department so that the company's territory will be adequately covered and at the same time the investment in stock and the selling expenses will be kept down and a profit can be made.

This company operates thirteen stores in the Upper Hudson and Mohawk Valleys, where we provide electrical service. In four of these towns we also operate gas plants, and for this reason we sell both electric and gas appliances.

In all of these towns we have salesmen who canvass their districts for certain appliances, and where the town is large enough to support a specialist we have men who specialize on certain articles and appliances. However, we find it necessary and advisable to use as much as possible the co-operation of manufacturers on the larger equipment such as electric refrigerators, heavy-duty cooking equipment, signs and similar appliances which require an engineering experience and a more detailed special knowledge than the average utility salesman would have.

At present we are working toward specialization among our salesmen, as we find that wherever we have put a man to work on one or two articles he not only produces more for the company but we are also able to keep a higher-grade man. This, of course, applies only to the highly specialized articles, and as a result our sales this year of electric domestic refrigerators and electric ranges have exceeded the sales of any previous years.

In order to educate the salesmen and improve their knowledge of specialties we hold a meeting every month and call upon some one of the manufacturers to give them a talk on his particular line. We have found these "get-together" meetings of material benefit in obtaining co-operation throughout the property as they bring the men together where they have an opportunity of exchanging views and solving individual problems which could not be done in any other way.

Centralized Storeroom

A minimum stock is carried in all stores, with a reserve at a central storeroom, which enables us to give the maximum service with the least investment in stock. The smaller towns cannot purchase in sufficient quantities to obtain the best prices, and by stocking the larger towns and transferring goods as needed to meet local conditions we have been able to dispose rapidly of appliances which otherwise might have been carried for a long period. We handle nothing but standard appliances of the best quality, and while some contractor-dealers may from time to time sell a cheaper article, we have found that by advertising, intensive sales effort and good service we are able to sell the better quality goods at the higher prices.

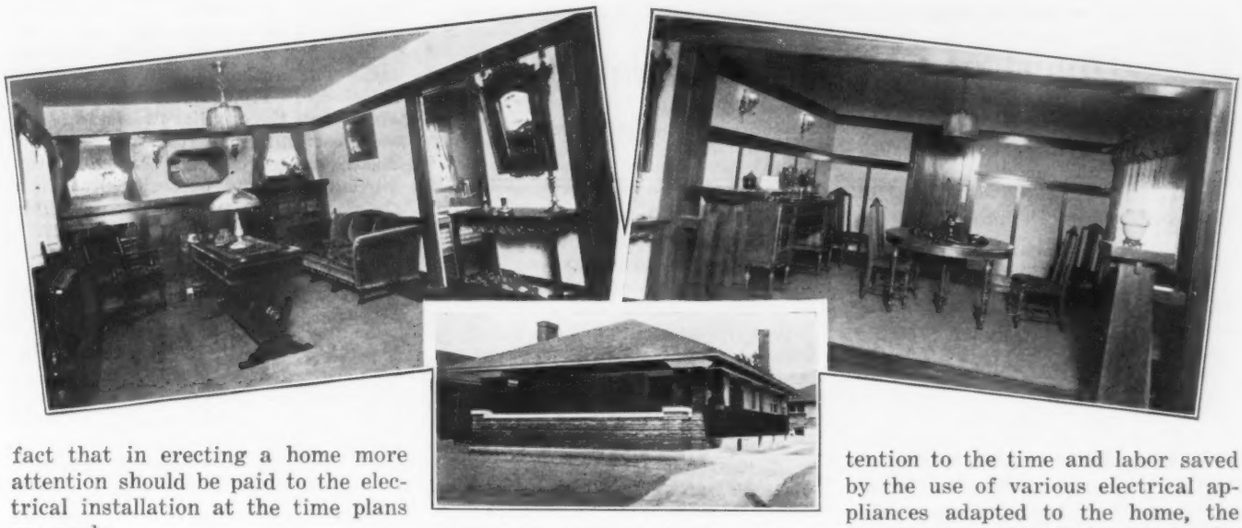
We had a rather large stock of appliances because of the slump of 1921, but with the exception of one or two items it has been closed out, and we are now approaching a point where we turn over our stock four times per year. We expect to improve this and should show a stock turnover of at last six by the end of this year.

Special sales are being outlined for the rest of the year so as to obtain the greatest benefit from general advertising and sales effort. On some articles we will run campaigns simultaneously throughout the property, and on others, with the co-operation of the manufacturers, we will run successive campaigns during the season in an effort to smooth out the sales curve and distribute the cost over the entire period.

Salt Lake Proves Moderate Cost of Electrical Home

IN EXHIBITING Salt Lake City's second electrical home the Rocky Mountain Co-operative Electrical League carried out the idea of featuring the extensive use of electrical equipment in the moderately priced residence. The house, as shown in the accompanying cuts, was a six-room bungalow and cost approximately $6,500 to build. During the two weeks that it was open, from July 25 to Aug. 6, slightly more than 10,000 people passed through and inspected the home.

The purpose of this electrical home, which was successfully carried out, was to demonstrate that a family of moderate means can enjoy the comforts and convenience of electrical appliances to a much greater extent than is usually supposed without the expenditure of a large amount of money. The wiring of the house provided a total of fifty outlets and twenty-two switches, and in conducting visitors through the building particular stress was laid upon the



VIEWS OF SALT LAKE CITY'S SECOND ELECTRICAL HOME, IN WHICH LOW COST WAS FEATURED

fact that in erecting a home more attention should be paid to the electrical installation at the time plans are made.

While this electrical home was not so expensive nor the display so large as the former one in Salt Lake, the appliances shown in each room were entirely appropriate and adequate for the modern electrically equipped residence. From a commercial standpoint this demonstration was considered to be of far more value to the local electrical industry because of its greater appeal to the majority of home builders, as the electrical equipment was representative of what could be easily applied to a house of moderate cost.

Selling 1,172 Irons in Thirty Days

ONE of the most successful campaigns to bring about a more widespread use of electrical appliances in the home was that carried on by the Utica (N. Y.) Gas & Electric Company in the sale of electric flatirons. This campaign lasted for one month, and during that period 1,172 electric irons were sold, a number far in excess of the mark set by the company.

The sale was handled by the commercial department of the Utica Gas & Electric Company, and the irons were sold to customers of the company under a deferred-payment plan, if desired, of one dollar on date of purchase and the balance in monthly payments of one dollar.

Four special canvassers were employed to call upon the customers of the company, and the men employed in carrying on a house-wiring campaign in the communities served by the Utica Gas & Electric Company were also pressed into service. In addition, employees of the company were interested, and sixty-six of these who became active were successful in selling 457 flatirons. These employees were paid the same commission as that paid the special canvassers—75 cents for each iron sold and an additional 15 cents for delivery to the purchaser.

The company interested fourteen of the electrical dealers in Utica and consignments of electric irons were placed with these dealers, who were paid the same commission for sales made and for deliveries as the special canvassers and company's employees. The newspaper advertisements and the display cards carried the names of all of the dealers participating in the sale. These dealers, in addition to selling 114 irons in a comparatively short time, reported a heavy increase in the sales of all other electrical appliances.

A noticeable feature of the campaign was that revealed by the reports of the special canvassers, who made a house-to-house canvass of the company's customers. These reports showed that an average of twenty-five calls were made in locating a single "prospect"—that is, a company customer not already owning an electric iron, indicating an already widespread use of this particular electrical appliance.

In addition to the immediate benefit accruing to the Utica Gas & Electric Company from the increased number of customers using electric irons, with the consequent increase in the energy consumption, there was the direct good accomplished by the widespread propaganda directing attention to the time and labor saved by the use of various electrical appliances adapted to the home, the benefit of which will be felt in the future increased business of the electrical dealers in the communities served.

What Other Companies Are Doing

Chicago.—To assist its salesmen in selling gas and electric merchandise, the Public Service Company of Northern Illinois has furnished them with a card file containing the names of all the consumers connected to the lines. This card carries a complete list of appliances with a small space beside each name so that a check can be made for the appliances already in use. A cross indicates that the customer is interested in that certain appliance. On the back of the card is a record of calls made on the customer, and a date is given for a return call. With this method no time is wasted in trying to sell the customer an appliance he already has.

Pawnee, Okla.—This city has voted to abandon its municipal lighting plant and has made a contract with the Oklahoma Gas & Electric Company for electric service to be delivered over a new transmission line in the company's Drumright division. Construction work has been started on this line, and in the meantime the city of Pawnee is making extensive additions and improvements to its local distribution system.

Edgerton, Wis.—This town has 700 homes, of which 674 are now wired. The Janesville Electric Company is now conducting a house-wiring campaign and expects to have the remaining twenty-six homes connected to its lines.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Hydro-Electric Power Plants in Styria, Austria.—R. HOFBAUER.—Plans are being laid out to supply the entire state of Styria (southern part of Austria) with electrical energy for general and railway use. A detailed survey of the power requirements for the next fifteen years showed that a total output of some 250,000 kw. will be necessary, while a hydraulic survey disclosed available water power of about 336,000 kw. Four main generating centers are under consideration, comprising nine new power stations with outputs ranging from 9,500 kw. to 136,000 kw. output each. These plants will feed into a three-phase, 100,000-volt transmission line for industrial load and into a single-phase, 60,000-volt line for traction, delivering a total of about 1,200,000,000 kw.-hr. annually. The realization of this project will require $30,000,000, for the greater part of which foreign capital is being sought.—*Elektrotechnik und Maschinenbau*, June 4, 1922.

Losses in Nozzles of Rectangular Section.—D. S. ANDERSON.—A series of experiments were carried out on nozzles of rectangular shape the results of which are given with a brief résumé of the analytical methods employed. The experiments were carried out using steam sufficiently superheated to insure that the whole expansion took place in the superheated field. A search tube was passed step by step down the axis of the jet, corresponding readings of position and pressure being taken. The supply pressure and temperature were carefully noted, and also the quantity of steam passing through the nozzle in a given time. This provided the necessary data to determine the nozzle performance.—*Engineering*, June 16, 1922.

Generation, Control and Switching

Behavior of Aluminum-Cell Arrester Under Radio-Frequency Electromotive Forces.—H. YAGI and J. OKOCHI.—By means of an oscillograph the behavior of the aluminum-cell arrester under radio-frequency electromotive forces is investigated. The dynamic characteristics and the cyclic current diagrams have been obtained for frequencies varying between 100,000 and 200,000 per second, from which the wave shape of the current and the potential against time are deduced. It is pointed out that the superior quality of the aluminum-cell arrester is that the static capacity of the film is considerably larger than with other apparatus and that the discharge characteristic is non-disruptive. The authors claim that these advantages are not possessed by any other type of arrester.—*Journal of the Institute of Electrical Engineers of Japan*, June, 1922.

The Application of Relays.—L. A. TERVEN.—An investigation showing how the fundamental relations of current and voltage in the electric circuit should be formulated in the study of relay connections, as these connections involve consideration of these values and their relative phase positions with respect to each other. Eight rules are given that should aid in the application of vectors to relay connections.—*Electric Journal*, June, 1922.

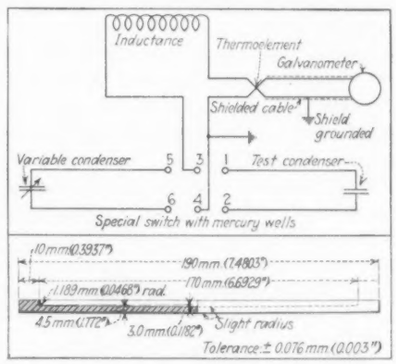
Transmission, Substations and Distribution

Developments in Power-Station Design.—Single and polyphase transformers, current-limiting reactors and rectifiers for railway use are considered in this article. The high cost of building has led many engineers to look into the possibilities of saving money by utilizing outdoor transformers. Various types of transformers of European make are described. Rectifiers up to a capacity of 225 kw. are now being used by many railways in Europe.—*Engineer*, June 9, 1922.

Modern 110,000-Volt Apparatus.—G. STERN.—The characteristic of all modern 110,000-volt electric indoor apparatus in Germany is the total absence of porcelain and the general use of hard-paper insulators. There are several reasons for this important change, which has taken place within the last eight years. Porcelain insulators cannot be manufactured within an accuracy of more than 5 per cent. Paper insulators, on the other hand, can be turned out on the lathe to any desired accuracy. The danger of cracking due to an expansion of the cement used between the porcelain and its metallic armature is eliminated in the paper insulator. In case of a flashover a porcelain is frequently destroyed, whereas paper is usually only charred on the surface and may be refinished. Finally, present conditions in Germany do not permit the building of such high-voltage porcelain insulators, at least not within a reasonable time. A disadvantage of the paper insulator is its restriction to indoor usage. Accordingly a roof or wall entrance bushing is made up of two halves, one of porcelain and the other of paper. All of the new paper insulators have as a special feature a corona ring mounted near the grounded end, which, the author claims, increases its dielectric strength from 50 to 60 per cent. The inner part of these hard-paper insulators is filled with a high flash-point compound. To permit expansion of this compound a special expansion box is provided at the grounded end. The author describes the latest models of 110,000-volt oil switches which have the auxiliary resistance contact restricting the rush of current at the instant of closing. Large rupturing capacity and explosion-proof construction are features of these switches.—*A. E. G. Mitteilungen*, June, 1922.

Units, Measurements and Instruments

Tentative Method of Testing Molded Insulating Materials.—The test applies to non-vitreous solid electrical insulating materials and consists of measuring the phase difference and dielectric constant of this material at radio frequencies. An electron-tube oscillator, the frequency of which can be varied



MEASURING CIRCUIT AND TEST SPECIMEN FOR TESTING MOLDED INSULATING MATERIALS

over the range desired, is used as the source of radio-frequency voltage. The measuring apparatus is shown in the accompanying illustration. The test condenser consists of the test specimen, a diagram of which is shown in detail with its dimensions, and two mercury surfaces as the conducting plate. The variable condenser is of special design having negligible phase difference. The frequency meters should have a range corresponding to wave lengths of 3,500 m. to 200 m. and be capable of calibration within 1 per cent accuracy. The phase difference of two specimens is measured by the resistance-variation method at five radio frequencies between 98 kilocycles and 1,200 kilocycles per second. The dielectric constant of a specimen is calculated from the capacity of a condenser in which the specimen is the dielectric and the capacity of which is measured by the resistance variation method. The report of the test should include a description of the material, room temperature and relative humidity, a curve for each specimen showing phase difference and dielectric constant plotted as ordinate values and wave frequencies as abscissas and the phase difference and dielectric constant of each specimen at wave frequencies of 100 kilocycles and 1,000 kilocycles per second.—*Report presented before American Society for Testing Materials*, June 26, 1922.

Illumination

Street Lighting and Public Safety.—EARL A. ANDERSON.—Significant data are presented on the relation of street lighting to traffic accidents and crime, with discussions of illumination systems for business, resident and outlying districts. With the purpose of collecting definite data regarding the values which should be attributed to the proper illumination of streets as a factor in the prevention of traffic accidents, a survey of such accidents in a representative group of cities (thirty-two cities with a combined population of over 7,000,000 people) was conducted. The result of this investigation is given. Types of fixtures, locations and distance apart are recommended for business streets, thoroughfares, resident streets, outlying districts, alleys and highways. Proper maintenance is described in full, as in many cases all that is required to avoid expensive waste of light is a cleaning of the lighting equipment at regular intervals and a prompt renewal of burnt-out or obviously defective lamp bulbs.—*Bulletin No. 46 of the Engineering Department, National Lamp Works of General Electric Company.*

Motors and Control

Parallel Operation of Commutating-Pole Motors and Generators.—C. B. HATHAWAY. — Although direct-current motors and generators have been operated in parallel for years, each time the machines do not parallel successfully many questions as to why they fail are asked. The author has reviewed the subject with the hope that those interested in this work may see the solution from a little different angle.— *Electric Journal,* June, 1922.

Maintenance of Electrical and Associated Mechanical Systems.—L. J. STEWART.—The procedure when handling equipment changes and maintenance of electrical systems, together with the purchasing and stock-keeping routine for the departments of the Western Clock Company, is outlined. This plant has a very complete and up-to-date system and is the result of careful planning by all the departments of the concern. Confusion and loss in the stockroom are avoided by strictly segregating the supplies used by the maintenance department from the raw materials used in production.—*Industrial Engineer,* July, 1922.

Heat Applications and Material Handling

Technology of the Carbon-Electrode Industry.—CHARLES L. MANTELL.—A critical review of the calcination process—why it is necessary and what it accomplishes—is given. The author considers the details of the design and operation of electric and gas-fired calciners, with special reference to their use in American practice. The development of calcining units has been along the lines of continuous furnaces with attention given to the preheating of charges and recovery of the heat of the material as well as the recovery of the combustible gases produced. This is the third of a series of articles in which the first reviewed the history of the industry and the second dealt with the raw material of electrode manufacture. —*Chemical and Metallurgical Engineering,* Aug. 2, 1922.

Standardization Rules for Electric Arc-Welding Apparatus.—Standardization rules approved by the American Bureau of Welding and proposed for adoption by the standards committee of the A. I. E. E. Three classifications of welding apparatus are made, namely, generators and motor-generators, transformers, and rheostats or reactors. Definitions of welding nomenclature are given, as is information relative to the apparatus which it is proposed to supply and conditions under which it is expected to be used. Tests of the apparatus include temperature rise and efficiency, the latter by the input-output method, and also efficiency by the conventional efficiency method.—*Journal of American Welding Society,* June, 1922.

Electrophysics, Electrochemistry and Batteries

Some Recent Conclusions Pertaining to Electrical Precipitation. — W. A. SCHMIDT.—Investigations into the phenomena of electrical precipitation of suspended particles from gases during recent years have resulted in important conclusions. The purpose of this paper is to present these conclusions without entering into a detailed discussion of the actual equations used in designing precipitators and the calculations embodying their use.—*Journal of the A. I. E. E.,* July, 1922.

Traction

Advantages of Railroad Electrification.—R. J. O'BRIEN.—This subject is considered under the headings "Through Trunk-Line Service," "Electrification of Heavy-Grade Sections," "Passenger Terminals," "Suburban Service," "Freight Yards" and "Tunnel Installations." Coal-saving projects of the type where it may be readily shown that the savings per year will carry the investment are also dealt with. In addition to the savings which can be readily calculated, there are usually many additional advantages to which it is impossible to affix a monetary value, but which may be governing factors in determining whether or not electrification is justified. The article considers the inherent characteristics of steam and electric locomotives and the methods of operation with both types of motive power. Every project requires a skill in engineering analysis in order to determine the feasibility of the electrification. The article is nine pages long and covers the subject quite thoroughly. —*Electric Journal,* June, 1922.

The Napa Valley Electrified Route.—A successful 3,300-volt, single-phase electric system is the 46.52 miles of electrified standard-gage track of the San Francisco, Napa & Calistoga Railway between the cities of Vallejo and Calistoga, Cal. Records of power consumption show an average input of 102.4 watt-hours per ton-mile and an average output of 64.8 watt-hours per ton-mile at the station, indicating a station efficiency of 63.3 per cent. The operating revenue per ton-mile for 1920 was 71.19 cents, while the operating expenses per car-mile were 40.1 cents, giving an operating ratio of 56.25 cents.—*Electric Railway Journal,* July 1, 1922.

Telegraphy, Telephony, Radio and Signals

Phantom Telephone Circuits Operated at Audio Frequencies.—J. G. HILL.—The theory of simultaneous telegraph and telephone working on the same circuit is first dealt with, and the limitations of this method of working are stated. The comparative efficiency of side and phantom circuits is calculated, and the principal problems arising from the loading and relaying by amplifiers of phantom circuits are outlined. The derivation of formulas for the calculation of electric wave filters is given in an appendix.—*Journal of Institution of (British) Electrical Engineers, June,* 1922.

Objects That Distort Radio Waves.—L. E. WHITTEMORE.—Tests carried out by the United States Bureau of Standards show that electric wires or cables, steel structures, rivers, trees, trolleys, stone and iron monuments all affect the direction of radio waves. These tests were made to determine the accuracy of the indication of direction finders.—*Radio Broadcast,* June, 1922.

Stationary Frequency Multiplier for Radio Service.—M. LATOUR.—With the use of a newly developed alloy steel which is ductile enough to be rolled into very thin sheets (0.05 mm.) and which has magnetic properties superior to silicon steel as far as the particular service is concerned, a 15-kw. transformer has been built capable of transforming 33,000-cycle current from a high-frequency generator into harmonic frequencies of 165,000, 230,000 or 300,000 cycles per second. The iron core of this transformer weighs only about a pound. Using the same principle of design, it will be possible to build a 150-kw., 100,000-cycle transformer with an over-all diameter of not more than 6 in. These new transformers, the author claims, will become great competitors with the electron tubes and high-frequency arc generators.—*Revue Générale de l'Electricité,* July 1, 1922, and *Radioélectricité,* June, 1922.

Miscellaneous

Varieties of Mica and Their Uses.—OLIVER BOWLES.—Canada, the United States and India produce about 97 per cent of the world output of sheet mica. Of this amount India produces about 65 per cent and the United States 15 per cent. About 90 per cent mined is scrap, most of which consists of material unsuited for sheet mica. The various uses of mica are outlined.—*Serial 2357, Bureau of Mines.*

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Coal Production Increasing

Disappointment Expressed, However, in Many Sections Over Seriousness of Outlook for Coming Winter

ALTHOUGH the production of bituminous coal has been considerably increased since the agreement between the operators and miners in the various coal-producing centers, the situation is not so satisfactory as some might think. Coal production has not begun to approach anything like normal and is far from what could be wished in some of the large coal-producing states.

While there is little likelihood that electric public utilities will be severely handicapped because of the shortage of production, there is every indication that industry in general will feel the pinch very much. As a result these industries are making every effort to obtain coal to keep them going regardless of price. This naturally has had its effect upon public utilities purchasing spot coal in the open market and has compelled some utilities to pay more than $10 a ton for fuel.

The House of Representatives on Wednesday passed the administration bill for a commission composed entirely of impartial representatives of the public to investigate the coal industry, and it is expected that the bill will pass the Senate within a few days. It is also hoped that a measure establishing a government price-fixing agency for the coal industry will be introduced and acted on quickly and favorably by Congress. The miners and operators in the anthracite region are deadlocked, and little hope is expressed for any production of anthracite coal for winter.

The railroad situation has not improved, but on the contrary settlement of the shopmen's strike is as remote now as ever. Hints have come from Washington that the government will not tolerate a breakdown in the nation's transportation system and that means will be found for speedily terminating the strike if such a breakdown is imminent.

Friends of Ford Muscle Shoals Plan Seek Vote in House

Advocates of the Ford offer for Muscle Shoals are awaiting an opportunity to have the Detroit manufacturer's proposition brought to a vote on the floor of the House. It will require a special rule to bring this issue up and such a rule admittedly will be difficult to obtain.

Representative Garrett of Tennessee, acting minority leader, as well as a number of Republican members, favors action, and he is seeking a chance to urge the subject upon the rules committee, but inasmuch as the majority of that committee do not appear to be favorable to it and the steering committee has refused to exert pressure in its behalf, the chances of getting a floor vote are slim.

De Forest Demonstrates His "Phonofilm"

A demonstration was recently given in Berlin to laymen by Lee de Forest of his "phonofilm," a device which is said to have solved the problem of the talking motion picture by making possible perfect synchronization between the reproduction of sound and of action. According to a cable dispatch from the Berlin correspondent of the New York *Times*, the method consists primarily of photographing sounds on a standard motion-picture film and then reproducing the sounds from this film. By a mechanical device it is possible to photograph ten consecutive "sound paths" on one strip of film. A thousand feet of film can, therefore, hold 10,000 ft. of photographed "sound paths," which can be run off continuously.

The ordinary standard motion-picture film is used as well as the standard motion-picture camera and the standard motion-picture projecting machine. Mr. De Forest's basic invention is what he calls the "photion," a glass tube with a bulbous end about 2½ in. long. This "photion" tube is fitted inside of a standard motion-picture camera, above and somewhat to the right of the objective. The secret of the "photion" tube is that without any filaments it generates a sufficiently powerful violet light under electrical excitation to photograph sounds as transferred through a slit only 0.2 mm. wide on a swiftly moving motion-picture film.

The sounds of a voice or voices, instruments or orchestra are picked up by a converter specially invented by Mr. De Forest. It is like the microphone of a telephone, only very much finer. The converter turns the sounds into telephonic currents. From the converter these currents pass into Mr. De Forest's audion amplifier, from which intensive electric currents pass to a high-frequency generator, whence they pass to and excite the "photion." The "photion" thereupon generates the intense violet light, which is controlled by voice or instruments.

Michigan Men Convene

Delegates to Ottawa Beach Meeting Discuss State Regulation, Rural Lines and Tree Trimming

STATE regulation, rural lines and tree trimming were the principal subjects of discussion at the annual convention of the Michigan Electric Light Association at Ottawa Beach on Monday, Tuesday and Wednesday of this week.

Sherman T. Handy, a member of the Michigan Public Utilities Commission, characterized the utility business as a three-party partnership of the company, the public and the state that must work together in harmony. He expressed himself as believing that rates should be commensurate with quality of service rendered and said that he could see no justice in allowing a company giving 100 per cent service no greater return than that allowed a company giving only an indifferent service. Mr. Handy asserted that more harm can come to a utility from its office than from its switchboard. He asked for the development of a service that would begin with the coal and water supply at the plant and end with the receipted bill to a satisfied consumer.

John F. Gilchrist, vice-president of the Commonwealth Edison Company, Chicago, in addressing the convention on public relations advocated careful training of employees in meeting and dealing with the public, taking as the measure of such dealings the way in which the executive would meet the consumer were it possible for him to have personal contact with customers in the way that the business man in the small business concern does.

The report of the rural lines committee emphasized the work being done for rural electric service by a committee composed of utility and farm interests under the supervision of the Public Utilities Commission. The chairman of this committee is David Friday, president of Michigan Agricultural College. Other members are the State Commissioner of Agriculture, the president of the State Farm Bureau and the entire rural lines committee of the Michigan Electric Light Association.

The convention was addressed by President Smith and Executive Manager Aylesworth of the National Electric Light Association.

Officers elected for the coming year are: President, Eugene Holcomb, Alma; first vice-president, S. B. Tuell, Houghton; second vice-president, R. Duncan, Detroit; secretary and treasurer, Herbert Sylvester, Ann Arbor.

New Orleans Utility Properties Sold at Auction

The properties of the New Orleans Railway & Light Company were sold at auction on Aug. 17 by the master in Chancery acting under instructions from United States Judge Rufus Foster. The sale was made in two parts, the first comprising all the real property, rolling stock and stocks and bonds except 958 gold bonds of the denomination of $1,000 and bearing 4½ per cent interest, which constituted the second part. There were only two bidders, who acted on behalf of the reorganization committee, G. H. Dahl, vice-president of the Chase National Bank of New York, bidding $14,500,000 for the first parcel and Charles K. Beekman of New York $620,000 for the gold bonds. The transaction now awaits Judge Foster's approval.

At a meeting of the Commission Council of the city Commissioner of Public Utilities Maloney withdrew the three ordinances that had previously been introduced and substituted three new ones in accordance with the agreement reached with the securities committee. These ordinances give the city an option to purchase the electric light company at $11,048,000, the street railway company at $25,000,000, and the gas property at $8,652,000 plus any additional amount invested in the property subsequent to Dec. 31, 1920. Indeterminate permits are granted in lieu of a franchise for a fixed period, the city to have supervision and control of the operation of the utilities. The city receives the right to levy on the gross receipts of each utility unit after the allowable rate of return is earned. This tax will, it is estimated, net the city about $320,000 annually.

Important Interests Acquire Hortonia Power Company

The Hortonia Power Company, operating an extensive hydro-electric system in central and western Vermont with headquarters at Rutland, has recently passed into the hands of a group of men well known in New England electrical circles and is now undergoing a rapid development. By Nov. 1 a carefully considered program of expansion will have been completed, and plans are now being made for further enlargements of the system next year. New transmission lines more than 50 miles in length and operated at voltages up to 44,000 have been built this year; the first unit of 750-kva. rating has been installed at the Weybridge development, which will have an ultimate rating of 4,000 kva., and various betterments have been made.

The company will shortly complete an additional reservoir in the Sugar Hill section which will double the storage available for the Silver Lake station, and a new 1,000-hp. unit to operate under 690 ft. head is under installation at this point. About 15,000 kw. in generating capacity is now installed on the system, and the company's engineers estimate that an economical development up to 40,000 kw. can be put through without steam installation, owing to the storage sites and water privileges obtained. At Port Henry, N. Y., the affiliated Port Henry Heat, Light & Power Company is facing greatly increased demands for electricity owing to the transformation of this mining community by the addition of plants for treating magnetite ore. George J. Murphy, president of both the electric companies under discussion, said to a representative of the *Electrical World* this week that the demand for electricity at Port Henry is expected to double within two years.

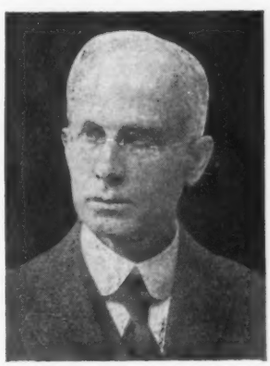
Plans for 1923 development include further enlargement of generating facilities, including 2,000 kw. in machinery for the Port Henry No. 3 station and 3,000 kw. for Weybridge. Vaughan Engineers, Boston, retained by the Hortonia company, are planning for the further development of 7,500 kw.

The officers of the Hortonia and Port Henry companies recently elected are: President, George J. Murphy, treasurer Pettingell-Andrews Company, Boston; treasurer and general manager Hortonia company, E. J. Taveniere, Rutland; Port Henry company, H. A. Barwise, Port Henry; secretary Hortonia company, L. C. Robinson. The directors of both companies are H. O. Phillips, Phillips Wire Company, Pawtucket, R. I.; C. B. Price, chairman directors Pettingell-Andrews Company; Frank S. Price, president Pettingell-Andrews Company; E. J. Taveniere; Major Gilbert R. Hodges, Boston, and I. M. Frost, Rutland.

Ryan Proposed for A. I. E. E. Presidency

Pacific Coast and Other Friends of the Noted Professor and Engineer Seek to Award Him the Highest Honor of the Electrical Engineering Profession

AN OUTCOME of the Vancouver (B. C.) meeting of the American Institute of Electrical Engineers this month is a movement for elevating Prof. Harris J. Ryan to the presidency of the American Institute of Electrical Engineers. Professor Ryan's many friends feel that this honor is due him and have experienced no difficulty in securing the necessary signatures to the petition placing his name in nomination for the presidency next year.



HARRIS J. RYAN

It is contended that there are few men in the engineering fraternity who possess more brilliant attainments or are more beloved than the professor who occupies the chair of electrical engineering at Leland Stanford, Jr., University. Moreover, the claim is made that some recognition is due the Far West, and that in putting forward the name of so distinguished a personage as Harris J. Ryan the West has chosen a man who would lend dignity and distinction to the office and one who, it is confidently expected, will receive the indorsement of all sections of the country.

It is pointed out that a graceful tribute to Professor Ryan's ability and standing in the profession was paid by the board of directors of the A. I. E. E. when they appointed him honorary vice-president of the Institute on the Pacific Coast during the Panama-Pacific Exposition. It was the belief of the board at that time that the importance of the occasion justified the creation of the special honorary office and that this appointment fulfilled a general desire to honor an eminent member and former vice-president.

As is probably well known, Harris J. Ryan, for many years, occupied the chair of electrical engineering at Cornell University, Ithaca, N. Y. In his early days important patents were awarded to him, notably in conjunction with M. E. Thompson for the Thompson-Ryan equipment and for repulsion and interpole motors. Since he has been at Stanford University Professor Ryan has acted in a consulting capacity for many of the great hydro-electric systems on the Pacific Coast. He has done important research work in connection with high-tension insulators. His research work during the war was also notable.

A Seven-Year Construction Program of $125,000,000

In its application to the California Railroad Commission for permission to issue 7 per cent preferred stock to the amount of $9,500,000, the Southern California Edison Company made the following estimate of its construction expenditures for the seven-year period beginning with the present year:

1922.....	$27,344,300	1926.....	$16,209,000
1923.....	18,055,800	1927.....	15,975,000
1924.....	13,829,000	1928.....	11,800,000
1925.....	22,290,000		
Total			$125,503,100

Senate Reduces Tariff on Electric Light Bulbs

Duty Placed at 20 per Cent ad Valorem—Other Reductions from House Rates on Electrical Goods Are Made—Foreign Valuation Replaces American Plan

A HEAVY reduction in the duty on incandescent electric light bulbs was made by the Senate in the closing days of the tariff debate, the rate standing in the bill as it goes to conference at 20 per cent ad valorem.

The House fixed a rate of 35 per cent on electric light bulbs, based on American valuation. This, roughly, is considered twice the rate based upon foreign valuation, and the Senate finance committee in redrafting the bill placed these bulbs in a paragraph with other illuminating articles—chimneys, globes, shades and prisms—with a recommended duty of 70 per cent. During debate this item came under heavy fire, it being charged that a monopoly exists which permits not only the domestic market but much of the foreign market to be controlled by an American company. As the result of the fight against the electric light bulbs, the committee was over-ruled by the Senate on all illuminating articles and the rate was reduced to 45 per cent.

Returning to the paragraph in the closing days of tariff consideration, the finance committee removed electric bulbs from the other items and restored them to a separate paragraph with a 35 per cent duty, as the House had done, the 35 per cent Senate duty being lower because of the difference in the basis of valuation—foreign as opposed to American. Senator Jones of New Mexico succeeded in having the 35 per cent rate lowered to 20 per cent, asserting that the bulbs can be produced here as cheaply as anywhere in the world. Senator McCumber declared that a committee of American workingmen who had investigated conditions abroad had recommended that a rate of 70 per cent would not be more than sufficient to protect electric bulbs.

OTHER CHANGES IN HOUSE BILL

Subsequently, by an amendment of Senator Sutherland, the Senate restored the 70 per cent duty on other illuminating articles, leaving electric bulbs in the separate paragraph at 20 per cent.

The Senate changed the House rate of 35 per cent on electrical measuring instruments to 50 per cent, which is a reduction, as the House rate was based upon American valuation and the Senate rate is based upon foreign valuation.

As the tariff bill passed the Senate it carries a duty of 45 per cent on carbons and electrodes for producing electric arc light, electrodes of carbon or graphite for electric furnace or electrolytic purposes, brushes for motors and generators, plates and rods for manufacturing brushes and other articles of carbon or graphite for electrical use and not specially provided for. On nickel electrodes a duty of 25 per cent is imposed. Both rates are lower than the duties fixed by the House, although the first one carries a higher figure, the difference being because of the change in the basis of valuation.

The Senate changed from 8 cents per pound to 25 per cent ad valorem the rate on asbestos paper for insulating and other electrical purposes. This effects a material reduction.

The duty on electrical storage batteries, plates and materials was reduced to 40 per cent. The original recommendation of the finance committee was 45 per cent, but the committee reduced this voluntarily. The House rate was 30 per cent upon American valuation, a higher rate.

The bill as it passed the Senate provides that an additional 10 per cent ad valorem shall be imposed upon table, kitchen, household and hospital utensils containing an electrical heating element.

Telephones, telegraph, trolley and electric light poles of cedar or other wood were placed on the free list on motion of Senator Kellogg. A duty of 10 per cent originally was imposed.

State Government Enjoins Tennessee Merger

An injunction against the merger into the Tennessee Power Company of the various utility companies of which it has acquired control was granted last week by a Nashville court to Attorney-General Frank Thompson, representing the State of Tennessee. The state authorities have filed a bill in the Chancery Court asking forfeiture of the charters of the Nashville Railway & Light Company, the Chattanooga Railway & Light Company, the Chattanooga & Tennessee River Power Company, the Tennessee Power Company, the Tennessee Railway, Light & Power Company and the Tennessee Electrical Power Company on the ground that these companies have violated the statutory law and the common law of the state by entering into an agreement or a series of agreements for organizing and maintaining an illegal combination in restraint of trade.

Municipal Electricians Widen Contact with Industry

The desirability of closer contact with the electrical industry as a whole was emphasized in the program of the twenty-seventh annual convention of the International Association of Municipal Electricians this week at New Bedford, Mass. In addition to topics of immediate interest to delegates in their daily work of maintaining fire and police telegraph systems, a number of questions of importance to central-station companies were listed for discussion. The convention opened Tuesday morning at the New Bedford Hotel, an address by President W. R. Arbuckle, Bayonne, N. J., being a feature of the program.

The subjects listed for Tuesday afternoon included "Reliable Fire-Alarm Signals as Applied to Automatic Sprinkler Systems," by David Reed, Denver, and "Black Streets Are Back Streets," by L. A. S. Wood, Westinghouse Electric & Manufacturing Company. On Wednesday the program included addresses on "Care and Maintenance of Fire and Police Signal Systems," by G. A. Jackson, Newton Upper Falls, Mass., and "Radio as Applied to Hazards, Rules and Inspections," by R. R. Moore, Westinghouse Electric & Manufacturing Company. Papers on "The Municipal Electrician and the Electric Power Industry," by Dr. Charles P. Steinmetz, Schenectady, and "The Reduction of Fire and Life Hazards at Meter Installations," by G. C. Langdell, Hodenpyl, Hardy & Company, Jackson, Mich., were given on Thursday.

Public Service Company's Big Waukegan Plant

Ground will be broken Sept. 1 for the new generating station of the Public Service Company of Northern Illinois at Waukegan, 40 miles north of Chicago. The plant will have an ultimate capacity of 250,000 kw. and may cost eventually about $22,000,000. The first unit will contain a 25,000-kw. turbine and three boilers of 1,430 hp. each. Contracts for this equipment have been awarded, and operation of the plant will, it is expected, begin in August, 1923. The building first erected will contain space for two units, the second to be of 30,000 kw. to 35,000 kw. rating. The cost of the first unit and the building, exclusive of the ground, will be approximately $3,000,000.

The site, just north of Waukegan, comprises 87 acres of land in the center of which is a natural pond covering 11 acres. An intake from Lake Michigan will assure ample water supply for the plant. The site is the last one available along the shores of the lake in the Chicago district. The only other available site is at the boundary line between Illinois and Indiana and is owned jointly by the Public Service Company and the Commonwealth Edison Company of Chicago.

A private right-of-way ranging in width from 85 ft. to 150 ft. from the site of the new generating station south to Lake Bluff, a distance of about 10 miles, has been purchased by the Public Service Company. A 33,000-volt transmission line will be built over this right-of-way connecting the Waukegan station with the rest of the Public Service Company's territory, which includes the great industrial district in northeastern Illinois, just outside of Chicago. An industrial district is being developed at Waukegan in the vicinity of the proposed new station, and big power users will be served from 12,000-volt lines.

Million-Volt Laboratory

California Institute of Technology Is About to Install One in Its Electrical Department

THE electrical department of the California Institute of Technology expects to have a laboratory in service in the fall in which potentials of 1,000,000 volts and even higher can be produced from line to ground. Voltages of this magnitude will be obtained by means of four 250-kva. transformers (3,000-6,000/250,000 volts) developed by Prof. R. W. Sorensen and being built by the Westinghouse Electric & Manufacturing Company. When connected for full voltage to ground three of the transformers will be supported on redwood insulating platforms, the fourth transformer being grounded.

The transformers may also be used independently or connected for the following conditions: (a) 1,000,000 volts with grounded neutral and 500,000 volts line to ground; (b) 500,000 volts step-up-step-down system, one side grounded; (c) 500,000 volts step-up-step-down system, neutral grounded; (d) three of the transformers may be Y-connected with grounded neutral to give 433,000 volts between lines; (e) single-phase combinations for 250,000 volts may be made.

Two-legged core-type transformers with one high-voltage terminal on the secondary are used, the other terminal being grounded. Each transformer will be equipped with means for connecting instruments at the grounded end of the high-voltage coil and with crest voltmeter connections, voltmeter coils, protective reactances, etc. The weight of each unit is approximately 45,000 lb. complete with oil.

Although the primary of each transformer is wound for 3,000/6,000 volts, the power for the laboratory will be supplied by a 50-cycle, 15,000-volt line. Connection between this line and the testing transformers will be made through automatic oil switches and two regulating transformers. By means of these transformers energy can be supplied to the testing transformers at voltages varying smoothly from 0 to 6,000 as desired.

A 20-kw. Poulsen arc set and other high-frequency and direct-current apparatus for high-voltage work will also be installed in the laboratory. The building which will house the equipment will have an unbroken metallic lining to prevent interference with the radio work of the community, a door in one side, 40 ft. high by 40 ft. wide, through which a transmission line may be taken out when desired, and a transformer pit in which the supporting structures for three of the transformers used in getting 1,000,000 volts will be erected.

The laboratory will be under the general direction of Dr. Robert A. Millikan, director of physical research and chairman of the executive council of the California Institute of Technology. Experiments will be conducted in conjunction with the research engineers of the Southern California Edison Company and other power companies of the West.

E. S. J. A. Questionnaire in Aid of New Business

A comprehensive questionnaire is being circulated among their customers by the salesmen representing members of the Electrical Supply Jobbers' Association in aid of the work of the Joint Committee for Business Development. The information is to be sought in every place visited by a jobbers' salesman and is to be sent by him to the house he represents. These houses will in turn forward the information to the headquarters of the Atlantic Division of the association in New York City. Thence the filled-in questionnaires will go to the Joint Committee for Business Development for tabulation. Since the jobbers' salesmen cover the entire country, it was felt that they better than any other agency could obtain the facts the committee wants.

The questions asked cover the activities of central stations, contractors and dealers and the degrees of aggressiveness and of co-operation displayed.

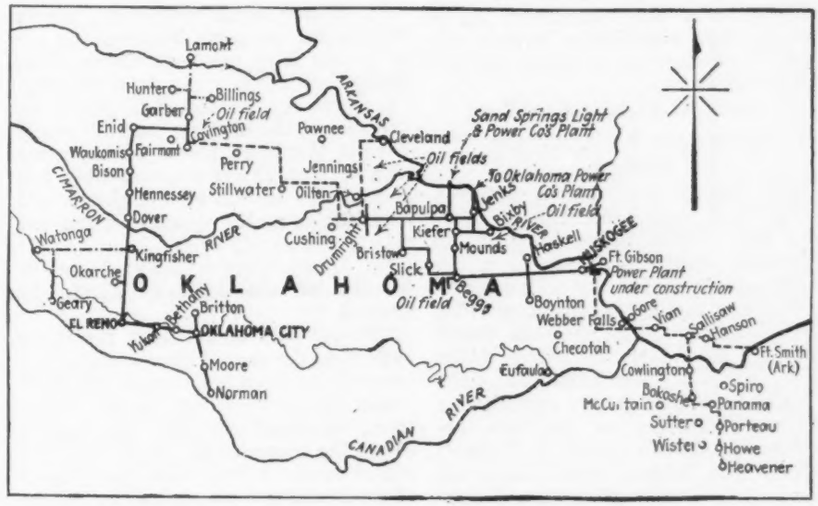
Rehearing Asked in Wisconsin Rate Case

The Deputy Attorney-General of Wisconsin, on behalf of the Railroad Commission, has filed a motion in the State Supreme Court for a rehearing of the case involving rates to cities on the "loop" system of the Wisconsin-Minnesota Light & Power Company (see *Electrical World* for July 29, page 219). This is the case in which the Supreme Court held that the commission was wrong in its method of unit cost distribution to the communities affected and decreed that the proximity of communities to a generating station should be taken into consideration. It is held that the decision establishes a principle in rate making which will hinder the development of electric service to small communities by transmission-line extensions, and it is also believed that the decision robs the commission of an important part of its power in the establishment of rates.

Work Begun on Oklahoma's Biggest Power Plant

Work has begun on the Oklahoma General Power Company's two-million-dollar power house on the east bank of the Arkansas River four miles northeast of Muskogee. It will be the largest electric power plant in the state and will require two years for completion. The company is controlled by H. M. Byllesby & Company.

Simultaneously with the beginning of construction work on the power plant work will commence on transmission lines to Checotah and Eufaula, where the electric plants were recently taken over by the Oklahoma company; to Fort Smith to connect with the Byllesby plant there, and to approximately a score of towns between Muskogee and Fort Smith.



TERRITORY SERVED BY OKLAHOMA GENERAL POWER COMPANY

The Arkansas River plant will have an initial installation of 10,000 hp., compared with the 4,600 hp. of the present Muskogee plant. The new plant will have one 7,500-kw. turbine of latest design, with space for another of equal rating. With the completion of the plant and transmission lines, the plants at Sapulpa, Drumright, Oklahoma City, El Reno, Enid, Muskogee and Fort Smith will be interconnected, and emergency lines will connect with plants at Sand Springs, Tulsa and the Oklahoma Railway Company at Oklahoma City.

The Oklahoma Gas & Electric Company, the parent corporation of the Byllesby interests in Oklahoma, has within the past few weeks acquired plants in ten towns. A number of municipal plants are included in this number. These will be abandoned and energy will be purchased wholesale from the Byllesby transmission lines.

Line Building in Indiana Co-ordinated

Electric Power and Telephone Utilities Accept Commission's Rules to Insure Safety and Prevent Inductive Interference on Transmission Systems

AFTER numerous conferences, Indiana utilities using electric wires have agreed upon procedure in the installation of wiring systems which will prevent loss of life and damage to property and save thousands of dollars in litigation, according to Earl L. Carter, chief engineer of the Indiana Public Service Commission. The movement began when the Indiana Telephone Association asked the commission to formulate rules and principles for safety and inductive co-ordination. Other utility companies agreed to send representatives to the conferences, and from that time until now much work has been done by all concerned. The new agreement provides that any party to it desiring to depart from the rules must petition the commission for a change, the commission having the right to make such changes for the public betterment.

The essential paragraphs follow:

Safety and Serviceability Sought

"All supply and signal systems should be so located, constructed, operated and maintained as to meet the reasonable service requirements of the public and in conformity with general co-ordinated methods as far as specified in these rules. These methods should facilitate the safety and serviceability of all systems. Reasonable foresight should be exercised in new construction and reconstruction to facilitate co-ordination between supply and signal systems and between supply or signal lines and the tracks of steam and electric railroad crossings.

"In situations where more than one set of facilities are now or are known to be likely to be concerned at some later date, as at crossings, conflicts and inductive exposures, each utility before locating and constructing new lines, or before making major changes in height, location or construction of existing lines, or before changing type of system, normal operating voltage, frequency or other operating conditions, shall give reasonable notice in advance in writing to all of the utilities that are now or are known to be likely to be concerned later, so that consideration may, when necessary, be given to any specific co-operative measures which may be advisable. Steam and electric railroads before making changes in tracks at crossings where signal or supply lines are involved shall give reasonable notice of such changes to the parties concerned and shall give due consideration to the requirements for relocating or reconstructing such lines. As an essential step in promoting co-operation there should be an interchange of pertinent data and information between the utilities concerned.

"Utilization of the highways is essential to the economical and efficient extension, operation and maintenance of supply and signal facilities. To avoid unduly increasing the number or difficulty of situations of crossing conflicts or inductive exposures incident to the use of the same highway by two different kinds of facilities, all lines should, in general, be located as follows:

"1. Where the conditions and character of the circuits permit, joint use of poles by signal and supply circuits is generally preferable to separate lines when justified by considerations of safety, economy and convenience, and presuming satisfactory agreement between the parties concerned as to terms and conditions.

"2. Where signal circuits and supply circuits on the same highway are not to occupy joint poles, or where either kind of circuit is alone on a highway, all signal circuits should be placed on one side of the highway and all supply circuits should be placed on the other side, so that, as far as practicable, one side of any section of a highway will be available as the signal side and one side as the supply side.

"3. Unnecessary crossings from side to side of the highway should be avoided.

"Where local signal lines are to be located on the same highway with local supply lines, joint use is generally preferable to separate lines, except sometimes in rural districts and except where the character of circuits involved makes separate lines on opposite sides of the highway more desirable. Where to be located on the same highway with transmission lines, separate lines on opposite sides of the highway are generally preferable unless a large number of service wire crossings would be involved, in which case joint use or other arrangements may be preferable.

Joint Use Preferred to Overbuilding

"Where toll or through signal lines are to be located on the same highway with local supply lines or lower-voltage transmission supply lines, separate lines on opposite sides of the highway are generally preferable, unless a large number of service wire crossings would be involved, in which case joint use or other arrangements may be preferable. Where proposed for location on the same highway or to follow the same general direction with higher-voltage transmission supply lines, co-operative consideration should be given to the question of whether such locations should be used and, if so, what specific co-ordinated methods are necessary. Where to be located on the same highway with higher-voltage transmission supply lines, separate lines on opposite sides of highway are preferable.

"Overbuilding of one line by another should be avoided where practicable. Where necessary for the two kinds of lines to occupy the same side of a highway, joint use is generally preferable to overbuilding.

"While signal or supply lines when alone should conform to general co-ordinated methods, such lines, pending the incoming or development of the other kinds of lines, may, if deemed economically advantageous, occupy locations or use types of facilities, construction and operating methods other than those conforming to general co-ordinated methods. However, the location and character of such facilities should be altered when and as deemed necessary to conform to these methods upon the incoming or development of another kind of facility conforming to general co-ordinated methods.

"When co-ordination of supply and signal lines of particular types cannot be technically and economically established under the methods of co-ordination covered by these principles, special co-operative consideration should be given to determining what location and type of construction should be established for each line of such type."

Sales Bureaus of N. E. L. A. Organize

The Lighting Sales Bureau of the National Electric Light Association has organized with the following officers: Chairman, G. Bertram Regas, Philadelphia Electric Company; vice-chairman, W. T. Blackwell, Public Service Electric Company, Newark, N. J.; secretary, J. Carl Fisher, Consolidated Gas, Electric Light & Power Company, Baltimore. There is an executive committee of twenty-four, of whom sixteen are members at large, representing every part of the country.

Responsibility of collecting and preparing data relative to various classes of service has been assigned as follows: Store lighting division, James Kirk, Commonwealth Edison Company, Chicago; residence lighting division, M. Luckiesh, National Lamp Works, Cleveland; industrial lighting division, J. Carl Fisher, Consolidated Gas, Electric Light & Power Company, Baltimore; large building lighting division, Charles C. Munroe, Detroit Edison Company; sign, display and billboard lighting division, H. H. Magdsick, National Lamp Works; street and highway lighting division, L. A. S. Wood, Westinghouse Electric & Manufacturing Company, South Bend, Ind.; commercial aspects of lamp equipment, G. H. Stickney, Edison Lamp Works, Harrison, N. J.

The officers named below have been selected for the Merchandise Sales Bureau: Chairman, F. D. Pembleton, Public Service Electric Company, Newark; vice-chairman, William Rawson Collier, Central Hudson Gas & Electric Company, Poughkeepsie, N. Y. The executive committee has twelve mem-

bers at large and will have twelve geographic division representatives, of whom eight have been appointed, as well as eight manufacturers' representatives and one representative each of the National Association of Electrical Contractors and Dealers, the National Electrical Supply Jobbers' Association and the Society for Electrical Development.

Seek Permits and Licenses

Recent Applications to Federal Power Commission Come Mainly from Pacific Coast

THE Southern Sierras Power Company of Riverside, Cal., has applied to the Federal Power Commission for a preliminary permit covering the construction of four storage reservoirs on the headwaters of Bishop Creek, a tributary of the Owens River, in Inyo County, Cal. The water is to be utilized in four existing plants on Bishop Creek. This improvement will make 14,000 hp. of primary power available, the application states.

Walter C. Brower, Spokane, Wash., has applied for a preliminary permit covering a power project on Phantom and Blue Grouse Creeks. He estimates that 2,000 hp. of primary power will be made available.

The city of Los Angeles has applied for a license to cover a power site in the San Francisquito Canyon.

The application of the city of St. Paul for a preliminary permit covering various sites on the St. Croix River, which has been held up until it can be shown that the municipality has authority to operate the projects, covers the Nevers, Lower Kettle, Upper Kettle, Markham-Kelsey-Druar and all other sites on this section of the river. The engineers for the city estimate that 15,000 hp. of primary power can be made available.

The primary power involved in three applications previously noted is as follows: Anaconda Copper Mining Company, 1,200 hp.; Charles E. Schaup, 15,000 hp.; Empire District Electric Company, 60,000 hp.

Farley Gannett, Theodore E. Seelye and J. D. Carpenter, 204 Locust Street, Harrisburg, Pa., have applied for a preliminary permit covering a power project on Juniata River in Perry County, Pa. The 10,000 hp. available is to be sold through an existing central station.

The Shasta Power Corporation of 445 Sutter Street, San Francisco, has applied for a license covering two transmission lines in Shasta County, Cal.

The Nevada Irrigation District of Grass Valley, Cal., has applied for a preliminary permit for an irrigation and power project on the middle fork of the Yuba River and on Canyon Creek on the south fork of the North Yuba and on the north fork of the Middle Yuba. The primary power available is estimated to be 45,000 hp.

P. B. Cross, San Francisco, has applied for a preliminary permit covering a power project on Deer Creek near Chico, Cal. The primary power is estimated at 9,500 hp., but the applicant indicates his intention to install equipment capable of generating 20,000 hp.

The Washington Coast Utilities Company of Arlington, Wash., has applied for a license covering a transmission line which will cross certain public lands near Waterville, Wash.

The San Diego Consolidated Gas & Electric Company of San Diego, Cal., has applied for a license covering a transmission line to connect the Rincon Indian Reservation and the Henshaw Dam.

Program of American Electrochemical Society

Final arrangements for the forty-second general meeting of this society, at Montreal, on Sept. 21-23, are being made. The technical program will open on Sept. 21 with the presentation and discussion of papers on electrolysis and electroplating. The recently organized division on electrodeposition will take part in the discussion of these papers. One of the papers will deal with the physical properties of electrolytic iron—a product which is being turned out commercially, contrary to all predictions of ten years ago. There will also be papers on zinc, brass and other electrodeposited metals. A symposium on industrial heating will be held on Sept. 21 and 22, under the auspices of the electrothermic division. Twelve papers on industrial heating in electric furnaces, other than fusion and melting furnaces, will be open to discussion. There will be an excursion to Shawinigan Falls. Headquarters will be at the Hotel Windsor.

West Virginia-Kentucky Engineers Draw Up Program

A number of electrical topics appear on the program of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers, which will hold its second annual convention at Huntington, W. Va., on Sept. 19 to Sept. 22. There will be papers on "Automatic Electrical Apparatus as Applied to Coal Mining," by M. A. Whiting of the General Electric Company; "How Mechanical and Electrical Men Can Increase Their Usefulness," by W. C. Shunk, general superintendent Stonega Coal & Coke Company, and "The Wireless Telephone," by M. W. Crenshaw of Huntington.

Committee reports will cover, among other subjects, methods of checking power costs, underground transmission and distribution, automatic electrical apparatus as applied to coal mining, all-rubber insulation as compared with braid-covered cables for portable extensions, the use in mine locomotives of resistance grids made of rolled-steel plate as compared with cast grids, and the proper handling and care of insulating oils.

Brief News Notes

Electrification of the Hungarian Railways.—The Hungarian government is making strenuous efforts to electrify the state railways through the agency of a special government commission. Trials are to be made of a single-phase direct-current locomotive to be built by the Hungarian State Machinery Factory in connection with the Ganz Electric Company of Budapest.

Getting Electricity from Geysers.—An unusual form of power project is reported from Santa Rosa, Cal., where plans are under way to generate electricity from the geysers in Sonoma County. "Enough steam," the report says, "will be produced at the geysers in northern Sonoma to operate turbines large enough to furnish electricity to light most of northern California. The steam will be generated by boring shafts into the torrid heat wells in the bowels of the earth."

Northwestern Central Station to Make Use of Radio.—The Northwestern Electric Company, it is reported, is installing a 1,500-watt radiophone set at its hydro-electric generating plant at White Salmon, Wash., about 75 miles from Portland. The set will be used to insure communication with the plant during storms and other adverse conditions. A similar transmitting set will be installed at Portland, and receiving sets at both places.

Pawnee Abandons Municipal Plant.—The city of Pawnee, Okla., has voted to discontinue the operation of its municipal light plant and has contracted with the Oklahoma Gas & Electric Company for electrical energy at wholesale rates to be delivered over the new transmission line of the Drumright division. Construction of this new high-voltage line will be started at once. The city's first municipal plant was installed in 1901 and after being flooded three times in one year was abandoned in 1908. The present city light and water plant was built in 1909 at an expense of more than $100,000.

Electric Drive on San Francisco Ferryboats.—Two new ferryboats about to be built for the San Francisco-Oakland Terminal Railways Company are to be equipped with electric drive. These boats will differ from those being equipped at New York for the municipal service there in employing direct current instead of alternating current. The motors will be of standard double-armature type and will be driven by a steam-turbine generator rated at 1,100 kw. The boats will be of the usual double-end type, and there will be a 1,200-hp. motor at each end, mounted on the propeller shaft. They will carry passengers between San Francisco and Oakland, the trip being made in fifteen minutes each way, a considerable sav-

ing in time. In addition to these boats, the Golden Gate Ferry Company, which already has an electrically driven ferryboat in service, is to build a companion boat with carrying facilities for eighty-five automobiles and 500 passengers.

St. Gothard Electrification Completed.—The St. Gothard Railway, 140 miles long, from Lucerne, Switzerland, to Chiasso, on the Swiss-Italian frontier, is now completely electrified for both passenger and freight traffic. It is just forty years since this railroad was first opened. With electrification the time consumed between the terminals will be shortened from five hours to four and passage through the many tunnels, the longest of which extends 9¼ miles, will be free from the inconvenience of smoke and closed windows.

Russia and the German Electrical Industries.—According to a report from Berlin, Professor Krug, who was sent to Russia in the interest of the large German electrical works, has just returned from Moscow and has reported that since the Rapallo treaty great interest in German electrical enterprises prevails there. Technical agencies and depots will be erected in various districts of Russia and Russian electric plants will be leased to German concerns. A special bureau for the purpose of further study of electric possibilities in Russia will be established by the German manufacturers at Moscow.

New York Electrical League Appoints Committee on Electric Cookery.—The New York Electrical League has appointed a committee on electric cookery, of which Robert B. Basham, manager of the electric department of L. Barth & Son, New York City, is chairman. It is Mr. Basham's intention to establish two sub-committees, one to develop domestic cookery in New York City and its environs and the other for commercial cookery work. Mr. Basham is an experienced electrical man who has been in direct touch with the manufacture and sale of heavy-duty and domestic electric cookery equipment.

Central Indiana Power Company Absorbs Four Electric Utilities.—The Wabash Valley Electric Company of Clinton, Ind.; the Putnam Electric Company of Greencastle, Ind., and the Cayuga (Ind.) Electric Company have been purchased by the Central Indiana Power Company, which has also acquired ownership of the Merchants' Heat & Light Company of Indianapolis. These properties will continue to be under the same operating control as at present, but the holding company will develop plans for expansion, including a 40,000-kw. plant on the Wabash.

Bangor Company Purchases Machias Property.—Additional hydro-electric facilities have been acquired by the Bangor (Me.) Railway & Electric Company through the purchase of the property and franchise of the Washington County Light & Power Company of Machias, Me., the transaction to be completed upon confirmation by the courts. The Machias property has lately been in the hands of a receiver. The property acquired includes a plant in Machias which for some years furnished that community with energy and a water privilege at Saco Falls on the Pleasant River with a concrete dam about 75 per cent completed. It is reported that the development will be continued by the purchasing company.

Electrical Activities in North Carolina.—The Southern Power Company is completing a transmission line from Hickory, N. C., to Lenoir, N. C., to make possible the electrification of cotton and other mills at Lenoir, Hudson and Whitnel which have ordered equipment. Another transmission line from Mount Holly, N. C., to Mountain Island, N. C., will bring the 8,000 hp. generated at the Mount Holly plant of the company to its new development at Mountain Island for distribution. Hydro-electric sites on the Haw and Deep Rivers, near Greensboro, N. C., have been surveyed by the State Geologist, and interested manufacturers are likely to carry these surveys further with the view of bringing about the exploitation of these streams.

Post Office Reports Results of Radio Experiments.—Constant experiments by the radio service of the Post Office Department to attempt to limit static interference in receiving are beginning to bring results and seem to indicate that the day of the aërial antenna for receiving is over. The following description of the tests conducted has been made by James C. Edgerton, superintendent of the radio section: "The air mail radio section has eliminated the use of regular transmitting antennas for receiving purposes altogether, as it has been found that the surveyor static conditions prevalent, especially in the Middle West, make receiving impossible. Very good receiving conditions with favorable signal static radio have been obtained, however, through the use of three different methods of receiving, which are selected to conform to local conditions. These are large vertical outside multiple-turn loops, underground horizontal buried loops and underground antennas. The best results are obtained with the underground antenna when it can be laid in damp soil with a straightaway of 1,000 ft. The horizontal buried loop is more or less of a new departure and has been very successful when well insulated and buried in water or very damp earth. In actual use well-constructed underground antennas such as are used in the majority of the fifteen stations in the air mail circuit have given rather unusual results. Communication has been carried on in the Middle West between air mail stations when lightning was actually striking near by. As a matter of fact, it has been possible to carry on communication when the currents induced in the antenna from nearby lightning discharges blew out the arc. Receiving on an ordinary antenna would have, of course, been impossible long before the storm reached the vicinity."

Associations and Societies

Springfield (Mass.) Organizes A. I. E. E. Section.—A section of the American Institute of Electrical Engineers has been formed at Springfield, Mass., to meet the wants of numerous engineers in that vicinity who do not find it convenient to attend the Boston meetings. This promises to stimulate interest in the Springfield territory and lead to an increase of membership. Beginning in September, regular meetings will be held. The principal officers are: Chairman, W. A. Dick, Westinghouse Electric & Manufacturing Company; vice-chairman, John M. Newton, Roland T. Oakes Company, Holyoke; secretary and treasurer, J. Frank Murray, United Electric Light Company, Springfield.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Conference of Local Electrical Leagues—Association Island, N. Y., Sept. 5-7.

N. E. L. A. Geographic Divisions — New England, New London, Conn., Sept. 5-8; Rocky Mountain, Glenwood Springs, Col., Sept. 11-13; Southeastern, Atlanta, Sept. 12-15; Great Lakes, French Lick Springs, Ind., Sept. 27-30.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 6-9. H. M. Stine, 212 Locust St., Harrisburg, Pa.

Colorado Electric Light, Power and Railway Association—Glenwood Springs, Col., Sept. 11-13.

Association of Iron and Steel Electrical Engineers—Cleveland, Sept. 11-15. J. F. Kelly, Empire Bldg., Pittsburgh, Pa.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept., 1922. Herbert Smith, 211 Holson-Pritchard Bldg., Huntington.

Pennsylvania State Association of Electrical Contractors and Dealers—Philadelphia, Sept. 13-14.

American Electrochemical Society — Montreal, Sept. 21-23. A. D. Spillman, Columbia University, New York City.

Illuminating Engineering Society—Swampscott, Mass., Sept. 25-28. Samuel G. Hibben, 29 West 39th Street, New York.

American Institute of Mining and Metallurgical Engineers—San Francisco, Sept. 25-28. F. F. Sharpless, 29 West 39th Street, New York.

National Association of Railway and Utilities Commissioners — Detroit, Sept. 26. J. B. Walker, New York Transit Commission, New York.

Indiana Electric Light Association—French Lick Springs, Ind., Sept. 28-30. Thomas Donohue, Lafayette, Ind.

Telephone Pioneers of America—Cleveland, Sept. 29-30.

American Electric Railway Association — Chicago, Oct. 2-6. J. W. Welsh, 8 West 40th Street, New York.

Empire State Gas and Electric Association —Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.

Electrical Supply Jobbers' Association, Atlantic Division—Philadelphia, Oct. 6. E. Donald Tolles, 165 Broadway, New York.

Society of Motion Picture Engineers—Rochester, N. Y., Oct. 9-12.

Association of Edison Illuminating Companies — White Sulphur Springs, W. Va., Oct. 11-14. Preston S. Millar, 80th St. and East End Ave., New York.

National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St., New York.

Public Utilities Association of West Virginia—Charleston, W. Va. Oct. 13-14.

Electric Power Club—Asheville, N. C., Oct. 30. S. N. Clarkson, 506 Laclede Gas Bldg., St. Louis.

Commission Rulings

Assessment of Extension Costs Against Customers Is Disallowed.—The Kansas Gas & Electric Company of Wichita, Kan., has been forbidden by the Public Utilities Commission of the state to charge the cost of extending its lines against the consumers benefited. A commission order issued in March, 1921, had allowed the company to assess customers on new extensions 165 per cent of the annual revenue from each connection made. The order reversing this ruling and forbidding a charge for extensions affects all the towns and cities served by the company —twenty or more in number.

Propriety of Rule Requiring Deposits.—Pointing out that losses to an electric service company caused by failure of certain customers to pay for the service received have eventually, if not otherwise provided against, to be borne by those who do pay, the Michigan Public Utilities Commission criticised the attitude of some prospective customers of the Callier & Kinyon Light & Power Company in the village of Saranac. These citizens, although satisfied apparently with the proposed rates, declared a firm objection to making the deposit of $5 asked by the company. The commission upheld the requirement, but said that the company would be allowed to accept in lieu of the deposit a written guarantee signed by a responsible resident.

Principle Governing Permission to Abolish Distribution Line.—Granting an application of the Idaho Power Company to discontinue service over a certain distribution line and dismantle it, the Idaho Public Utilities Commission said: "An electric utility should be permitted to abandon a distribution line operated at a loss when the abandonment of this service in no wise interferes with the general system or plan of development, but is more in the nature of a special service for certain patrons and has no intimate connection or relationship with the rest of the system." Such a line, the commission went on, should not be allowed to share in the depreciation reserve.

Approval of Southern California's Financing Plans.—In authorizing the Southern California Edison Company to reclassify its stock and to issue and sell $9,500,000 of 7 per cent cumulative non-participating preferred stock to retire outstanding second preferred stock and for development purposes, the California Railroad Commission said: "The applicant under its present financial structure has but two sources from which to get moneys to finance permanently its construction expenditures, such sources being the sale of common stock and the sale of bonds. Its officers believe that it should have a third source of funds, namely, the sale of preferred stock. It is argued that there is a group of investors who will not buy common stock but who are interested in acquiring preferred stock and that the company will be able to get its money cheaper through the sale of bonds, preferred stock and common stock than through the sale of bonds and common stock only. The commission's attention is also called to the fact that one individual now owns and controls $12,029,900 of applicant's outstanding stock and that it is not to the best interest of the company to have so large an amount of stock eventually pass into the hands of owners who might take a different attitude toward the management of these properties from that taken by the present owner of the stock."

Current Prices Improper Basis for Valuation.—Discussing the contention of the Pacific Gas & Electric Company that prices and costs obtaining on the date of the filing of the application for rate adjustment must be used, the California Railroad Commission said: "Aside from the fact that the valuation presented by the company's engineers itself violates this theory within a wide margin, the commission should reject this theory. No public utility plant of any size can be built in one day. The commission in the valuation work done by its own engineering department should adhere to the rule laid down in the Redding case, that valuation estimates must be predicated upon a normal and reasonable construction period under normal and reasonable construction conditions, and this rule should have its influence on the labor and material costs and on the so-called overhead allowance applied to an inventory."

Wholesale Power Service Rates in Southern California. — The Southwestern Portland Cement Company, the Golden State Portland Cement Company and the American Trona Corporation, served by the Southern Sierras Power Company, applied to the California Railroad Commission for a material reduction in rates on account of the economic competition which they could offer in the way of generating their own electric power, because the existing rates were, in their opinion, very much in excess of both the value and the cost of the service rendered, and because the rates resulted in discrimination between consumers and companies engaged in similar lines of business situated south of San Bernardino and supplied by other electric utilities. The commission held that the differential in rates did not result in discrimination, that service should be rendered under regular schedules and not under contracts, and that costs could not be allocated to single districts or cities. The commission found that conditions warranted the fixing of a new rate applicable to wholesale power service for industrial use effective in the entire territory served by the company outside of its Blythe and Yuma districts.

Recent Court Decisions

Eminent-Domain Proceedings to Acquire Site for Transmission Line Upheld.—The Indiana Supreme Court has upheld the defendant company in a suit (Jones vs. Indiana Power Company) brought to set aside the condemnation of certain small tracts of property for electric transmission-line towers on the ground of misrepresentation. The court found that the company's allegations were sufficiently specific to be clearly understood and that the original complaint was not open to the objection that it sought to take a fee simple for purposes for which the statute only authorizes an easement to be appropriated. (135 N. E. 332.)*

Recovery for Damage Caused Through Contact of Wires Barred When Both Parties to Suit Were Negligent.—In Morris vs. Sierra & San Francisco Power Company the plaintiff obtained a verdict for damages in the lower court because of the destruction of his property caused by a short-circuit between plaintiff's high-tension and telephone wires. The telephone wire fell upon a telegraph wire owned by the defendant, and fire broke out in his store as the result. The California District Court of Appeal reversed the verdict, finding that neither plaintiff nor defendant had observed the clearance rules prescribed by the Railroad Commission and that the contributory negligence of the plaintiff forbade recovery. (207 Pac. 262.)

Toll Charges of County Against Central Station Lines Upheld. — Tulare County vs. City of Dinuba was an action involving the right of the county to recover from the San Joaquin Light & Power Company 2 per cent of annual gross receipts for the use and operation of a franchise over the public highways of the county. The California Supreme Court sustained the act under the provisions of which the suit was brought and held that the "gross receipt" charge under this act is neither a tax nor a license, but a toll which the holder of the franchise undertakes to pay for the use of the highways, being a matter of contract. The case was reversed and remanded for a new trial, that a distribution of the payments according to the relative mileage may be had within the intention of the act, the Supreme Court pointing out the absurdity of the position that any integral part of an electric distributing system is entitled to credit for the whole of the earnings from deliveries and sales in a given county or municipality, when a large part of such service is over parts of the system not subject to such franchise permit. (206 Pac. 983.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Calvin W. Rice Delegate to Engineering Congress

Calvin W. Rice, secretary of the American Society of Mechanical Engineers, has been appointed official delegate to the engineering congress to be held in connection with the International Exposition at Rio de Janeiro. Mr. Rice, who goes as the emissary of

C. W. RICE

organized engineering in the United States, and who for purposes of representation at the congress has been elected an honorary vice-president of the A. S. M. E., sailed from New York Aug. 23 on the steamship *Pan-America*. A dinner in his honor was given at the Engineers' Club, New York City, Monday evening, Aug. 21, at which distinguished engineers, publicists and educators from many cities were present.

Mr. Rice, in addition to his work at the congress, will visit numerous South American engineering centers in behalf of the American Society of Mechanical Engineers and of organized engineering in general. His itinerary includes Rio de Janeiro, Buenos Aires, Santiago, Valparaiso, Callao and Havana. Mr. Rice plans to return to New York about Nov. 12.

Officers of Central Indiana Power Company

Joseph H. Brewer, who is well known in the utility world and particularly in Indiana, is president of the group of companies the ownership of which was recently acquired by the Central Indiana Power Company. These include the Wabash Valley, Putnam and Cayuga Electric companies as well as the Merchants' Heat & Light Company of Indianapolis. Mr. Brewer's ability to provide capital for progressive and growing utilities is well known.

Charles O'Brien Murphy of Indianapolis becomes general manager of all the operating companies. H. R. Ellis becomes responsible for the financing. Both of these men are vice-presidents, as is also Marshall V. Robb, who is to have charge of the companies' future development. J. W. Robb and C. M. Poor remain on the directorate of the Wabash Valley, Putnam and Cayuga companies.

Changes in G. R. & P. Company Personnel

W. F. Edwards, formerly superintendent of employment and instruction for the Georgia Railway & Power Company, has been appointed assistant superintendent of transportation to succeed E. G. Gramling, who has been transferred to the claim department. J. J. Duncan, formerly an instructor in the transportation department, has been appointed superintendent of employment and instruction, to succeed Mr. Edwards.

D. L. Gaskill, Greenville, Ohio, was recently re-elected secretary-treasurer of the Ohio Electric Light Association for the current year.

Frank Espy of Canton, Ohio, was elected vice-president of the Ohio Electric Light Association for the year 1922-1923 at the convention recently held at Cedar Point, Ohio.

C. A. Sears of Keokuk, Iowa, was elected first vice-president of the Iowa Section of the N. E. L. A. at its recent meeting at Lake Okoboji.

F. F. McIntosh, associate professor in metallurgy at the Carnegie Institute of Technology, will supervise courses in metallurgy, electricity and physical chemistry prescribed for graduate officers of the United States Naval Academy which are to be given at the Carnegie Institute next fall.

E. B. Phillips of Jacksonville, Fla., has been appointed instructor in electrical engineering at the Carnegie Institute of Technology, Pittsburgh. He will join the staff of the College of Engineering on Sept. 1. Mr. Phillips was graduated from the Georgia Institute of Technology in 1917 and for the two years following was an electrical engineer with the Western Electric Company in New York City. During the past two years Mr. Phillips has been instructor in electrical engineering at the United States Naval Academy, Annapolis, Md., and also at the Georgia Institute of Technology.

J. L. Catlin, general superintendent of the Bridgeport (Conn.) plants of the General Electric Company, has been chosen vice-president of the Engineers' Club of Bridgeport. Mr. Catlin succeeds W. J. Newton, who has resigned.

H. A. Shepard, superintendent of telegraphy of the New York, New Haven & Hartford Railroad, with headquarters at New Haven, Conn., has been appointed superintendent of electric transmission and communication, with the same headquarters, and the position of superintendent of telegraphy has been abolished. The jurisdiction of Mr. Shepard's new office will include all lines of electric communication and transmission on the system, including the electrified territory between New York and New Haven.

C. A. Corney Joins Staff of Boston Edison

Chester A. Corney, electrical engineer with Stone & Webster, Boston, has resigned to enter the electrical engineering department of the Edison Electric Illuminating Company of Boston. Mr. Corney was born at Boston in 1892 and after being graduated in electrical engineering at the Massachusetts Institute of Technology in 1914 spent a year as an assistant in the dynamo-electric laboratories of the institution. He then entered the employ of Stone & Webster and after a period of construction work in connection with power-supply problems on the Boston Elevated Railway was transferred to the Boston office of Stone & Webster for drafting and design service. In 1916 he entered the engineering department of the firm, and he has since been occupied with a variety of work, including electrical problems for the United Electric Light Company

C. A. CORNEY

of Springfield, Mass., the Philadelphia Electric Company's Delaware station, the American Sugar Refining Company, Baltimore, and the Queens Borough (N. Y.) Gas & Electric Light Company. Mr. Corney is a member of the A. I. E. E. and the N. E. L. A.

Lawrence Russel, formerly manager of the Armstrong-Whitworth Company of Canada, has been appointed manager of the Celite Products, Ltd., Montreal.

Alfred F. Duemler, formerly sales engineer of the Philadelphia office of the McClave-Brooks Company, has been promoted to the position of assistant manager of the Pittsburgh office.

T. D. MacMullen, secretary and sales manager of the Majestic Electric Development Company of San Francisco, has recently been made secretary-assistant manager of the company.

George Blair, Jr., has been placed in charge of the Pittsburgh office of the McClave-Brooks Company. Mr. Blair will continue to direct the work of the Philadelphia office in the capacity of district manager.

H. L. Hergett, manager of the Pittsburgh office of the McClave-Brooks Company, has been selected as manager of the Syracuse office to replace W. H. Goodrich, who has recently resigned.

George M. Moffett of New York, vice-president of the Corn Products Refining Company, has been elected to the board of Allis-Chalmers Manufacturing Company, to fill the vacancy caused by the death of W. T. Abbott.

H. B. Ennis Joins Bryant Electric Company

Harry B. Ennis has recently been appointed a field representative in the metropolitan district for the Bryant Electric Company of New York City. Mr. Ennis is well prepared to fill the rôle for which he has has been selected because of the contact which he established with many contractor-dealers in Brooklyn during the seven years he served with the new-business department of the Brooklyn Edison Company.

H. B. ENNIS

After leaving that company he became associated with the Duplex Lighting Works of the General Electric Company as illuminating engineer and later represented the H. S. Whiting Company as sales engineer in the metropolitan district.

Vincent Gray, formerly secretary of the Standard Electric Construction Company of New Orleans, La., has recently severed his connection with the company.

N. E. Camp has resigned from the General Electric Company to become vice-president and chief engineer of the Roberts Engineering & Construction Company, Marysville and Sacramento, Cal.

S. D. Green, formerly associated with the Worthington Pump & Machinery Corporation, New York City, has been appointed sales engineer in the Boston office of the Elliott Company, manufacturer of power accessories.

Trice M. Bell, formerly assistant instructor in the electrical engineering department of the University of Illinois, is now connected with the lighting department of the General Electric Company at Schenectady.

T. E. Hosley, formerly with the Washington Water Power Company of Spokane, is now connected with the Los Angeles sales organization of the Western Electric Company.

Prof. F. C. Bolton of the department of electrical engineering of the Agricultural and Mechanical College of Texas has been appointed dean of the School of Engineering, to succeed Dean Nagle.

J. Elmer Housley, formerly assistant power superintendent of the Aluminum Ore Company, East St. Louis, Ill., has recently joined the Aluminum Company of America, Kansas City, Mo., in the capacity of sales engineer.

S. Herbert Lanyon has been recently appointed Western manager for the Okonite Company., manufacturer of insulated wires and cable, and will maintain offices in the New Call Building, San Francisco.

J. H. Rodger, Western manager of the Safety Car Heating & Lighting Company, with headquarters at Chicago, has been promoted to be vice-president in charge of that company's Western business, with the same headquarters.

F. J. Schlink, formerly of the development branch of the engineering department of the Western Electric Company, New York City, has been appointed assistant secretary of the American Engineering Standards Committee.

H. D. Shute, vice-president and general sales manager of the Westinghouse Electric & Manufacturing Company, has been elected a member of board of directors of the Standard Underground Cable Company, Pittsburgh.

Dr. A. A. Hamerschlag has resigned as president of the Carnegie Institute of Technology. He plans to enter the business field as adviser and consultant to business organizations. He has been engaged in educational work since 1892 and has been a cogent factor in the development of the great institute. Dr. Hamerschlag plans to establish offices in Pittsburgh and New York.

Dr. Thomas Stockham Baker, secretary of the Carnegie Institute of Technology of Pittsburgh for the past three years, has been appointed acting president. The resignation of Dr. A. A. Hamerschlag from the presidency necessitated the selection of an executive in charge and Dr. Baker has been chosen. He has had wide experience in educational fields and in his capacity as secretary has been actively identified with various movements contributing to the remarkable growth of the institute.

W. M. Fagan Joins Chicago Flexible Shaft Company

Walter M. Fagan has resigned his position as manager of the appliance division of the Edison Electric Appliance Company, Chicago, after seven years' service, in order to join the Chicago Flexible Shaft Company.

W. M. FAGAN

A. B. Saurman, general sales manager of the Standard Underground Cable Company, Pittsburgh, has been elected a vice-president of the company and will combine the duties of his new office with those of general manager of sales.

Obituary

Alexander H. Patterson, for many years vice-president and general manager of the Phoenix Glass Company of Pittsburgh, died recently at his home in New York City. Mr. Patterson was one of the pioneers in the electrical industry on the Pacific Coast.

James Kennedy, engineer and editor, died recently at his home in New York City. Mr. Kennedy was seventy-two years old and at the time of his death was editor and president of the Angus Sinclair Publishing Company. Previously Mr. Kennedy had been managing editor of *Railway and Locomotive Engineering*.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Price Buying of High-Tension Equipment

Manufacturers Largely to Blame, but Purchaser Suffers Because Quality of Product Is Impaired

By J. M. Livingston
Sales Manager Electric Power Equipment Corporation, Philadelphia, Pa.

THE last few years have had a demoralizing effect not only upon the market for high-tension equipment, but upon many other lines of manufactured apparatus. The end of the war brought a buyers' market, and, prices being high, there developed a certain amount of price buying which was out of all relation to the importance of price as a factor in the proper selection of this kind of apparatus.

High-tension equipment used in power houses and on outdoor substations and transmission lines is bought primarily for two purposes—first, service; second, safety. The first consideration must be quality, for it is protection that is desired by the central-station companies, and if the material cannot be absolutely depended upon to stand up under heavy stresses, no central station or individual plant can afford to install it, no matter what its cost may be. The price, therefore, should be a secondary influence in the selection of this class of material.

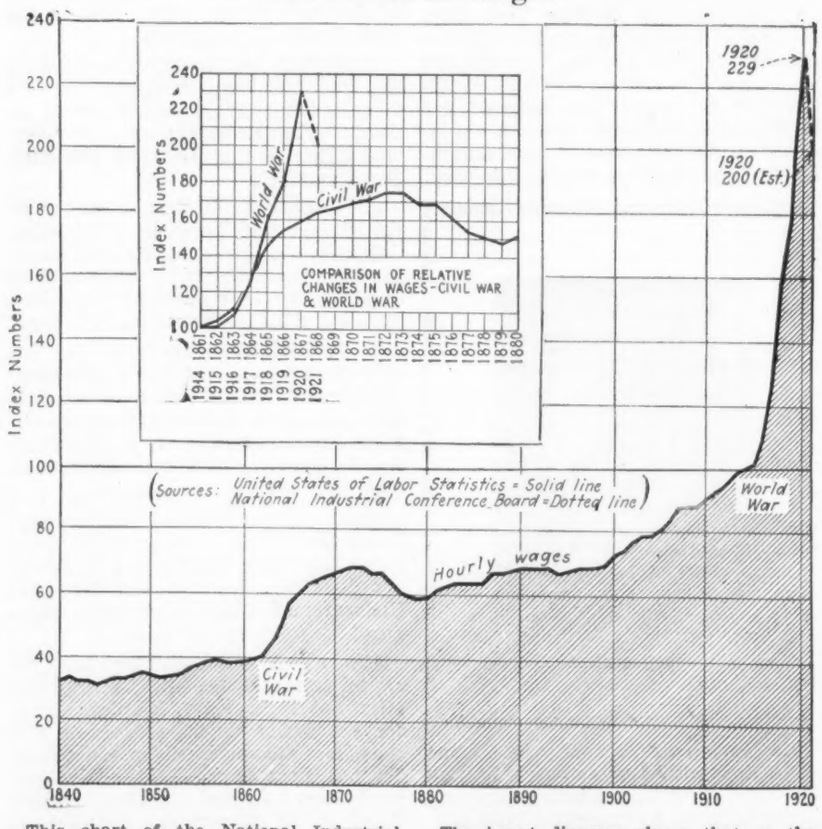
Result of Close Figuring

The depression which followed the war period resulted in part cessation of extensions to transmission lines and power houses, and competition for this class of business became keen. Manufacturers are, therefore, to a degree, to blame for the condition of price buying that exists at the present time, because, on account of the small amount of business available for the high-tension equipment manufacturers, the tendency was to figure on close profits, and, of course, the buyer took advantage of this circumstance.

It is quite natural for the buying public to allow itself to become interested in purchasing material at the lowest possible price, but too often the real purpose involved is lost sight of or subordinated. Central-station companies have continuity of service to provide for their consumers, and in purchasing protective equipment the important factor is to obtain insurance against possible failure of that device. Quality should, therefore, be very carefully weighed against the price, and to obtain quality manufacturers must carefully consider the matter of design, the materials used and the kind of workmanship applied. These are naturally and unavoidably reflected in the price.

Bartering over prices and shopping around to match one manufacturer against another is not really bartering for price alone, but usually for quality as well, although apparently this is not fully realized. In reality, securing a lower price is accomplished generally by finding some competing equipment that does not show the best design, workmanship and materials, yet is offered for the same service. If we would but stop to think of it, that is not at all what the buyer wants, for he knows that above all else the device must be safe and proof against breakdown. The buyer would not willingly select inferior quality, price being even, but the tendency is to select inferior

The Trend of Wages



This chart of the National Industrial Conference Board shows that there has been a steady upward trend in wages except in the two post-war periods and that hourly wages in 1921 were approximately six times as high as they were in 1840.

The insert diagram shows that on the same basis of comparison the rise of wages during the Civil War more nearly resembles that which has been caused by the World War than is apparent from the long time trend.

quality, price being uneven, there being a failure to consider the fact that this inequality in price usually indicates comparative standards in quality.

The manufacturers recognize that the buyer wants the best quality and is always ready to pay for it when he can be shown that the price is fair, and it is therefore their duty to convince the purchaser of high-tension equipment that this present era of price buying is not to the best advantage of those concerned. It is time that we took this message to our customers and supported it by reasonable and soundly based arguments.

Room for Every Manufacturer

Further Comments on the Small Manufacturer's Distribution Problem and a Reply to the Complaint that Distribution Is Too Much Controlled

By W. R. Herstein,
Vice-president and General Manager Electric Supply Company, Memphis, Tenn.

THERE is still much to be said on the subject of distribution in the electrical industry, and the article which appeared in the *Electrical World* recently by "A Small Manufacturer" is evidence of the extent to which misunderstandings may creep in, and opinions differ. This manufacturer complains that he finds the available supply of jobbers pre-empted by old-line manufacturers, and that a few of the largest manufacturers have so closely affiliated themselves with their distributors as to impel the complainant to classify the latter as "kept jobbers."

Since some one must take up the gauntlet thus thrown down, it may not be amiss for the writer, who is not what the Small Manufacturer terms a "kept jobber" but gladly claims close kinship with them, to point out to this manufacturer some of the injustice in his complaint. If the "Small Manufacturer's" particular product were known, the task might be simplified, but in the absence of this information it may be assumed that his line is a general one, and I will follow that assumption.

The Kinds of Distribution

Manufactured products are marketed in this country largely by three methods of distribution—the centralized mail-order house, the chain-store system and the independent operator. All three methods lend themselves economically to the purposes for which they were created, and America is large enough to afford a legitimate and profitable field to each line of endeavor. While it is hardly fair to designate the manufacturer-controlled jobbing house as a chain store, yet, in a glorified sort of way, it is approximately that, and its ownership or management is entitled to credit for the fact that, notwithstanding its connection with practically unlimited resources, its competition is upon the same fair and businesslike basis as that of the most reputable independent jobbers, while from the personnel of its executives are recruited some of the most valuable leaders of the Electrical Supply Jobbers' Association.

Others Too Lose Customers

It is not the writer's purpose to answer the "Small Manufacturer's" indictment by recriminations, but the first thought impressed upon his mind by the manufacturer's complaint was that in venturing into the electrical field, he leaped first and looked afterward. Prudence should have caused him to investigate the market before entering it, and if, then, he had discovered the situation to be as he has outlined, he could have applied his energies and capital in other directions, where the field might be less competitive. Parenthetically, however, it may be doubted whether such field exists, since, if reports from other lines are true, there is no reason to feel that competition has not singled out our own industry for its principal activities.

The "Small Manufacturer" has charged that he, and others in his class, have lost many good customer-distributors by their becoming affiliated with one of the larger manufacturers. Granting, however, that the loss of important customers is a serious matter, the "Small Manufacturer" is in no worse case than the jobber, to whom the experience of losing half a dozen central-station customers at one fell swoop, owing to their purchase by some syndicate, is by no means novel. This is an ordinary hazard of business. Customers are lost just as customers are gained.

Majority Still Uncontrolled

All the foregoing, of course, even if correct, affords no consolation to the "Small Manufacturer," but here is a morsel of comfort for him. There are probably three hundred electrical jobbers in the country. The two large manufacturers he has in mind are affiliated with about seventy-five. By such affiliation they voluntarily refrain from competing with him for the business of the remaining 225. If the two largest manufacturers can market their output through one-fourth the trade, therefore, surely the "Small Manufcturer" can find an outlet through the remaining three-fourths, if he produces a meritorious article at a reasonable price, with fair compensation to his distributors—and shoulders faithfully and consistently his share in the burden of creating a demand for his product and popularizing the use of electricity.

There is a big job still to be done by the manufacturers and distributors of electrical goods and by the central stations and contractors. The idea of utilizing complete electrical equipment has got to be sold to the public and the market broadened and developed. There is room for every manufacturer and every jobber now in business and a lot more. But the problem needs creative work, and organization is required to get it done. Therefore, it seems to me that it is not the time to accuse the most highly organized and effective groups of jobbers in the industry of blanketing distribution and holding back the progress of the industry, but rather to search out a way for the small manufacturer to build up for himself also a better distribution than he says that he now has.

Two Kinds of Competition

There are two kinds of competition among manufacturers. One kind competes for the division of the clearly apparent market, each competitor contending for the largest possible share of the existing business. The other kind competes in the creation of new business and in the service of the active existing market. The manufacturer who is constructively increasing the demand for his goods and progressively creating new uses and new markets has no fear of restricted opportunity.

Survey of Business Conditions

Says No Group Can Fix Arbitrary Fuel-Oil Prices

Under existing conditions in the oil industry, no one company or group of companies is strong enough to fix an arbitrary price for crude petroleum or its products, according to evidence given by R. L. Welch, secretary of the American Petroleum Institute, before the Senate committee on manufactures, in connection with the committee's oil inquiry.

Prices have been declining since early in July, Mr. Welch told the committee, because of an overproduction of crude oil.

"Overproduction will inevitably force down the price of oil," Mr. Welch said, "just as a demand in excess of the supply will cause the market to rise."

Scarcity of Coal Hampers St. Louis Business

Industrial activity in the St. Louis district is materially hampered by scarcity of coal, and the situation regarding stocks and deliveries is daily becoming more critical. This is directly restricting electrical sales to industrial companies, and indirectly, through its depressing effect upon business generally, it is causing a slowing down of sales in virtually all lines of electrical goods.

A few construction jobs of industrial character have been deferred from this fall until next year. Weather conditions the past week have been unfavorable to agriculture, but because of the lateness in the season the detriment will not be great.

Cleveland Building Industry Shows Much Activity

Midsummer finds the building industry in Cleveland making remarkable progress. There are few, if any, idle men in the ranks either of skilled craftsmen or common labor. The strike situation has resulted in an advance in the price of some lines of building materials, and the increasing demand is also responsible for the higher cost. Added to this is the increased cost of labor, all of which does not seem to have retarded to any appreciable extent the demand for new structures.

Cleveland's building operations show an increase of almost 20 per cent over last year, using June, 1922 and 1921, for comparison. The building commissioner issued 946 new construction permits in June, 1922, valuations amounting to $9,446,450. The records for June, 1921, show that only 620 new construction permits were issued and the valuation was $8,063,355. Alteration permits decreased in number this year, but valuations show an increase. A summary of both classes shows an increase in valuations of $1,651,715.

This is regarded by the trade as indicative of brisker business conditions among the builders, and obviously a more active money market prevails.

Cities Service Company Storing Oil Following Price Cuts

Henry L. Doherty, president of the Cities Service Company, announced last week that his interests are beginning the purchase of crude oil in addition to storage of production wherever it is practicable.

"The recent cut in crude oil," said Mr. Doherty, "was not surprising to any thinking oil man, for conditions have been such for many months as would justify a drastic cut.

"I am glad to say that the subsidiary petroleum producing and refining properties of the Cities Service Company are in an enviable position. We have available storage tanks with a capacity of 4,000,000 barrels, and if the price of crude oil has not recovered when they have been filled, we will build additional storage capacity and buy more crude oil so long as this opportunity prevails."

Points Out Important Use of Copper in Radio

The part played by copper and brass in the development of radio telephone is described in a bulletin of the Copper and Brass Research Association just published. The report states in part as follows: "Large demands are reported by manufacturers of copper wire, sheet, tube and bar stock for copper in one form or another for use in radio apparatus.

There is not a single instrument of a radio sending or receiving set but that requires copper, brass or bronze in its construction. The high electrical conductivity of copper makes it absolutely essential for all switches and parts using wire to convey the delicate electrical impulses received from the air. Brass, because of the ease with which it can be machined, is largely used for binding posts, plugs, audion bulb bases and the like. Where unusual strength is a requirement, phosphor or silicon bronze finds wide application.

"Sheet copper and brass are used in the construction of the adjustable condensers that assist in increasing the strength of the electrical impulses. From one to three condensers of ten to thirty plates each are necessary to the average amateur receiving station."

July's Industrial Construction Largest in Two Years

More industrial building construction was started in July than in any other month since November, 1920, according to figures compiled by the F. W. Dodge Company. The amount is given as $31,882,000, or 9 per cent of the month's total of $350,081,000 for all building operations. The total is 2 per cent above that for June, 1922, and 65 per cent over that for July, 1921. It is greater than any previous monthly total except the record figures for April and May of this year and marks the fourth successive month of unprecedented building activity.

Building contracts in the district comprising Illinois, Indiana, Michigan, Wisconsin, Iowa and Missouri, amounting to $124,655,000 in July, gave the largest monthly figure ever recorded. Construction in this district during the first seven months of 1922 has amounted to $595,668,000, or 29.2 per cent of the total of $2,041,065,000 for the twenty-seven states covered (everything north and east of a line from Topeka, Kan., to Savannah, Ga.). The total is 60 per cent above the figures for the first seven months of 1921.

Canadian Reports on Electrical Market in Scandinavia

Norman D. Johnston, Canadian Trade Commissioner at Rotterdam, recently sent to the Department of Trade and Commerce at Ottawa a report on the market for electrical apparatus in the Scandinavian countries.

"In general, it may be said that among the products in demand in Scandinavia are electrical motor accessories, household electrical articles such as irons, toasters etc.; heating apparatus, electrical machinery of various kinds, material for the government railways and power plants, equipment for the municipal light, heat and power plants, as well as all kinds of electric fittings and cables. Heating apparatus is coming largely from the United States and Switzerland, while Germany supplies most of the imported light fittings. In most of the electrical products it is very difficult to compete with the low German prices which are quoted on account of the low exchange value of the mark. A similar factor also applies in the case of those products manufactured in Norway and Sweden, where the currency is depreciated. It may, therefore, be said that until conditions become more normal a large proportion of the trade which is not done by Scandinavian firms themselves will go to Germany. At the present time business in electrical products is not very good on account of the slump in trade, but it is very likely that there will be a large trade done in the future as there are uncompleted power, heating and lighting schemes which will mean a demand for transformers, motors and all kinds of machinery and cables, also lighting, cooking and heating apparatus."

Unsettled Conditions Affected Sale of Toys and Novelties

That merchants have not placed orders for electrical toys and novelties for the first six months of the year to the usual extent, for the obvious reasons of unsettled conditions and the tendency of those firms that have liquid capital to hold on to it, is the outstanding feature of a report just received by the *Electrical World* from a leading manufacturer of novelties. The president of this company says:

"Within the past two weeks conditions have changed materially, and we are receiving more orders than is usual at this time. It is our belief that immediately after Labor Day buyers will display added energy for the purchase of novelties, and that the season will show unusual activity. All materials, practically, are advancing, therefore prices are bound to stiffen."

Prevailing Conditions Affecting Cost and Volume

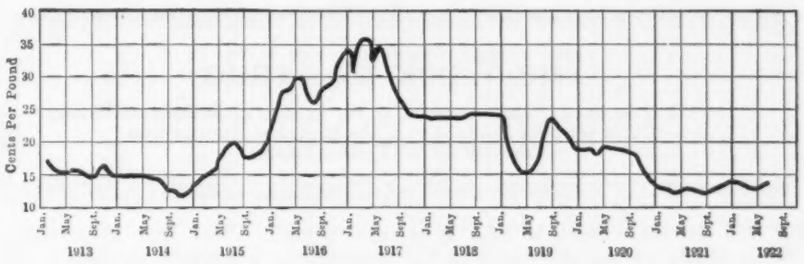
Bank Clearings Increase.—A decided widening of the ratio of increase in the bank clearings over last year's figures has been witnessed this week, an aggregate of $6,056,323,000 at twenty cities in the United States representing a gain of 18.1 per cent over the $5,129,444,800 of a year ago.

Failures Continue Gain.—Increased failures in the South and West this week over-balanced the decreases shown in the East and Pacific sections, so that the total for the United States is somewhat larger than it was last week. Defaults reported to R. G. Dun & Company for this week number 415, as against 402 a week ago and 357 a year ago.

Steel Output Further Reduced.—While the more favorable turn in the labor situation has improved the industrial outlook, iron and steel works are till seriously handicapped by the effects of the protracted suspension of coal mining and interruptions to railroad traffic. From practically an 80 per cent rate of operation earlier in the summer, the principal producer is now running at only about 60 per cent of capacity, and some independent companies are not averaging better than 50 per cent.

Business Volume 11 per Cent Larger—Volume of business for the week ended Aug. 16 was $7,969,000,000, marking an increase of $16,000,000, or about 2 per cent, over the total of $7,808,000,000 reported for the preceding week. As compared with the week ended Aug. 17, 1921, the volume of business for the week under review shows an increase of $794,000,000, or 11 per cent.

Export Trade Less Favorable.—A reduction of more than $90,000,000 in the nation's favorable trade balance during July as compared with a year ago will help the international exchange situation, the Commerce Department declared last week in a statement making public the results of the country's foreign trade for the month.



MONTHLY AVERAGE QUOTATIONS OF ELECTROLYTIC COPPER DELIVERED. COMPILED BY THE "DAILY METAL TRADE."

Poles on Free List.—The Fordney-McCumber tariff bill, passed by the Senate Aug. 19, placed poles on the free list. The rate proposed was 10 per cent.

Coal Production Is Very Low.—Bituminous-coal production last week is estimated at about 4,300,000 tons by the Geological Survey. There were 4,576,000 tons mined in the previous week.

Warn Against Establishment in Germany.—Warning against the establishment of branch factories by American firms is contained in a report to Secretary Hoover by a special committee of business men appointed to handle economic problems relating to western Europe. The report asserted that any temporary advantage to be gained by the location of branches in Germany by American firms would be more than offset when stabilization in that country brings on further violent financial dislocation.

Metal Market Situation

Copper Remains at 14 Cents—Wire Manufacturers Demand More Than Brass Makers

Another week has passed in copper with no change from the 14 cents price. The copper demand by wire manufacturers has been considerably better than the demand from brass makers.

Sales, foreign and domestic, during the last three months have averaged about 160,000,000 lb. a month. Shipments, foreign and domestic, have for the last three months averaged around 165,000,000 lb., the largest recorded for any three consecutive months in the peace-time history of the copper industry.

Before the war the United States normally exported about 60,000,000 lb. of copper a month. Without any especially important buying from the Orient, expor s for the first half of this year have averaged 58,000,000 lb. a month compared with 46,000,000 lb. for last year, making European consumption, despite untoward political and industrial conditions, practically equal to the pre-war figures. Domestic consumption for the first half of 1922 has been somewhat better than 80,000,000 lb. a month, compared with about 65,000,000 lb. before the war, or about 20 per cent higher.

The main cause of this increase in domestic consumption has been the great expansion of the automobile industry since 1914 and the much increased consumption of copper by the hardware trade. Copper is consumed largely as brass in these industries, and the full effect of the two factors mentioned has not yet been felt in the copper market as only now have excess stocks of scrap brass in this country been used up. Consequently any decrease in fall demand for copper products either from the automobile or the hardware trade should be more than balanced by the smaller amount of scrap brass that will be used.

Europe has practically no available supplies of scrap brass and copper. British supplies have been exhausted by recent German purchases, and Germany with her own scrap used up will have the British scrap consumed by December. The only source of any brass supply in Europe outside Russia, where scrap supplies are not believed to be important, is the brass of the cartridge cases in the excess stocks of munitions that France has on hand. There is every indication that this French cartridge-case brass will come on the market very gradually, at least until France is much more certain of the future tranquillity of Europe than her national leaders are today.

ELECTROLYTIC COPPER PRICES

Average prices in New York

	1922	1921	1920	1919	1918
Jan.	13.60	12.85	19.02	20.00	23.50
Feb.	12.97	12.79	18.61	16.91	23.50
Mar.	12.84	12.23	18.36	15.01	23.50
April	12.71	12.54	18.54	15.40	23.50
May	13.29	12.83	18.28	16.01	23.50
June	13.71	12.76	17.97	17.65	23.50
July	13.90	12.35	18.61	21.71	25.89
Aug.	.....	11.76	18.44	22.22	26.00
Sept.	.....	12.10	18.04	21.95	26.00
Oct.	.....	12.75	16.30	21.50	26.00
Nov.	.....	13.16	14.39	19.96	26.00
Dec.	.....	13.67	13.48	18.48	25.29
Average	.....	12.65	17.50	18.90	24.68

NEW YORK METAL MARKET PRICES

	Aug. 9, 1922 Cents per Pound	Aug. 23, 1922 Cents per Pound
Copper		
Prime Lake	14.00–14.25	14.00
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	5.75	5.75
Antimony	5.25	5.25
Nickel, ingot	36.00	36.00
Zinc, spot	6.50	6.50
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00–11.25	11.00–11.25
Brass, heavy	5.75– 6.25	5.75– 6.25
Brass, light	5.25– 5.50	5.25– 5.50
Lead, heavy	4.62½–4.75	4.62½–4.75
Zinc, old scrap	3.00– 3.37½	3.00– 3.37½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE electric market is held at a standstill by the deadening influences excited by the coal and rail strikes. In some quarters it is believed that if a quick settlement comes business in materials will go ahead and become progressively active in a very short period. Conduit stocks are reported lower each day, shipments of pipe from the Pennsylvania district being held up. Poles are not moving so quickly and some price stiffening is noted. A good market for fixtures in schoolhouses is reported and manufacturers are busy supplying the demand. Lamps are selling well, especially in the ordinary sizes.

New York

Market Without Feature—Conduit Stocks Reported Low—Lamp Supply Ample for Present

Last week's electrical market was without feature. No price changes are reported, although there is a gradual stiffening in quotations for flexible armored conductor and pole equipment. Conduit stocks continue to decrease. Lighting fixtures are selling well and lamps are in greater demand.

Conduit.—Construction is still causing the heavy demand for the smaller sizes. Stocks in some quarters are reported as very low.

Lamps.—Demand is mostly for the ordinary types. Stocks are reported ample for present needs.

Flexible Armored Conductor.—This material is still very active for rewiring and smaller construction jobs.

Motors.—Increased demand in the smaller sizes is reported. Great activity is expected in the coming fall months.

Chicago

Armored Conductor Holding Its Own—Wiring Materials Flow Steadily—Pole Movement Satisfactory

Market for electrical equipment for the past week has been steady. Wiring materials have been selling at the same steady rate as in the previous weeks and prices are still firm. High-tension manufacturers report a brisk business. The pole market, while quiet during August, has been up to jobbers' expectations. The call for fans was hastened by a week of warm weather.

Conduit.—Prices are still firm, but the supply of the smaller sizes is still scarce. In 5,000-ft. lots the ½-in. black pipe sells for $47 and $47.50 per 1,000 ft.

Flexible Armored Conductor.—Steadily holding its own and dealers' stocks are normal. The No. 14 two-wire, single-strip is available in 5,000-ft. lots for $44 and $45 per 1,000 ft.

Wire.—An active building program is calling for a goodly volume. The No. 14, rubber-covered, is quoted at $6.35 per 1,000 ft. in 5,000-ft. lots, and prices are firm. Jobbers' stocks are in good shape.

High-Tension Equipment.—A sale was announced during the week by one manufacturer for fifty lightning arresters rated at 37,000 volts for a utility in southern California.

Poles.—Although August is a quiet month for this equipment, the movement of poles has been satisfactory. Extensions and rehabilitations are calling for most of this material. The 7-in. top, 30-ft. Western red cedar sells for $8.70 f.o.b. Chicago, and the same size in Northern white for $9.20 f.o.b. Chicago.

Boston

Fixtures for Schoolhouses Active—Gaps in Conduit Stocks—Cross-Arms Slow

Trade was extremely spotty as the week began. Deliveries are more uncertain, shortages in rigid conduit and hard-pine cross-arms being reported. Railroad labor conditions are greatly improved in this territory and textile mills are resuming work in strike-ridden localities. Building contracts for the week ended Aug. 15 totaled $7,067,600 for New England, by far the best in two decades. Last year's record for the same week was $3,912,818.

Fixtures—Sales are active for schoolhouses. Stocks are satisfactory and prices firm. Collections on small accounts are poor in some cases.

Wire.—Weatherproof base rose to 17 cents Monday. Sales are fair. Rubber-covered No. 14 at $6.25 per 1,000 ft. in 5,000-ft. lots is in moderate demand. Bare copper wire at 16 cents base is stirring somewhat owing to transmission demands.

Rigid Conduit.—Gaps in stocks are being filled by local purchases at a premium in order to gi e service, a leading jobber reports. Prices are firm.

Fans.—Sales are very light in wholesale circles, but a fair season is reported considering the cool weather of the past two months.

Cross-arms.—Shipments on arms from distant sections are slow and unsatisfactory. Reasonable allotments for current demand are being made out of stocks, however, in Boston jobbing circles.

Dry Cells.—Although the vacation trade is practically over, orders are holding up well. Easy deliveries are reported.

Switches.—Industrial betterment work is absorbing good volumes of this product, along with house wiring. Competition is active, and sales are very diversified.

St. Louis

Loom Demand Spotty—Interest in Industrial Heating Equipment Increasing

Loom.—Demand is somewhat spotty but of fairly good volume owing to extensive residential construction. Stocks are conservative. In 250-ft. coil lots prices per 1,000 ft. are $14.80 for 7/32-in. size and $18.90 for ¼-in. size.

Flexible Armored Conductor.—Stocks, though conservative, are ample for the demand, which was off this week. A representative quotation on No. 14, two-conductor, is $60 per 1,000 ft. in lots less than 250 ft.

Industrial Heating Equipment.—Increased interest is manifested due to greater sales efforts on the part of manufacturers and central stations. A large manufacturer of piston rings has placed an order for an 87-kw. furnace to be used in "normalizing" its rings. Increased usage of electric heating is also found in the japanning of automobiles, one company having recently installed heating units in its steam ovens to increase production.

Soldering Materials.—Steady demand has existed for some time and stocks have been built up to meet it.

Bells and Buzzers.—Rapid completion of residential construction jobs, and particularly of large hotels and apartments, is giving stimulus to demand, while stocks are in good condition. One type of bell is quoted as follows: 2½-in., $41 per 100; 3-in., $44 per 100; 4-in., $50 per 100. Buzzers are selling at $40 per 100 to $46 per 100, depending upon grade.

Bell-Ringing Transformers.—Slight improvement in demand is reported, but the total volume of sales remains small. Stocks are of ample proportions. Representative prices in lots of ten are from 80 cents to 85 cents each, varying with type and size.

Cleveland

Slight Spurt in Fan Sales—Expect Motors to Be Active in Fall—Radio Dull

Business in electrical goods for the first seven months of the current year is reported to show a healthy increase over the last seven months of 1921. This increase is pretty well distributed over the various lines, with sales of apparatus for the home particularly strong.

The automotive equipment business, consisting of starting and lighting devices for automobiles, has improved

considerably in the past six months. Public utility lines are on a firmer basis, and the electric railway industry is gradually working back to normal.

Fans.—A slight spurt in sales marks the end of a conservative fan season. There remained sufficient surplus to attract jobbers who are stocking up for the spring activity.

Motors.—No activity is expected in motor sales until well into the fall months, but the number and nature of inquiries received indicate that brisk trading with firm prices will prevail. Occasional requests are received for specification quotations but orders are far from being in proportion.

Radio Equipment. — Manufacturers, jobbers and dealers are experiencing depression in sales and attribute it to "summer dullness," caused by the lack of interest in such entertainment devices by consumers during the warm weather.

Washing Machines.—Progressive activity in sales is reported with substantial orders from jobbers and dealers. Prices remain the same and no difficulty is experienced in shipping.

Atlanta

Oil Switches Selling Well—Fixtures in Better Demand—Glass Type Insulators Popular

While the railroad strike has not materially interfered with passenger traffic, nevertheless considerable difficulty is being experienced in the receipt of freight shipments, particularly heavy material. Coal is becoming scarce, retailers refusing new orders in a large number of instances. This shortage has caused the shutdown of a large number of plants throughout the section, one of the largest cement mills having shut down last week. The rail tie-up is also being reflected in the difficulty in obtaining conduit, a general shortage existing. Business continues good, even in the face of these discouragements, and will experience almost a real boom if there is an early settlement of the strikes.

Industrial Motors.—There is a fair movement, with demand for the near future very promising. The electrification of industrial plants will take the greater portion of this business. Stocks and shipments are good with prices steady.

Oil Switches.—A fair volume of sales is reported, though it is not in keeping with motor activities.

Schedule Material.—Commercial and home building is holding up sales with prospects of continued sales into the fall.

Lighting Fixtures.—Approaching fall is responsible for a brisk demand, but failure to receive shipments is causing a shortage in residential types. The demand seems to be for the better and higher grade of goods.

Distribution Transformers.—A fair movement is reported, with prospects looking up on the fall trade, owing to municipal-plant and central-station expansion. Local stocks in the popular sizes are fairly good, but there is some delay in getting the larger sizes.

Wire.—A brisk demand is reported in all the popular sizes, with a fairly heavy demand and inquiries for the larger cable for industrial plant use. Stocks have reached a satisfactory point with prices steady.

Insulators.—The glass type continues to lead in popularity. There is also a fair demand for the high-tension types for use on the 11,000-volt and 66,000-volt transmission lines under construction.

San Francisco

Cleaners Attracting Attention—Greater Interest in Ranges Shown—Pole-Line Hardware Active

The railroad strike situation is better. Fruit shipments are again moving with only small loss to growers. Very little non-employment is reported.

Appliances.—Dealers realize need of reorganization and redirection of effort. Comparatively few firms are specializing actively just now, but a large number are quietly gathering data for future efforts.

Vacuum Cleaners.—Attachments are increasingly popular. A big September washer business is predicted.

Radio.—Radical broadcasting revision is expected. Stocks are high and demand is markedly improved. Excellent fall business is expected.

Ranges.—The Pacific Gas & Electric Company is staging a series of sixty combination lectures, entertainments and demonstrations of electric cooking.

Pole-Line Hardware.—One of the largest selling items. Several large, well-assorted stocks are maintained in San Francisco.

Portland–Seattle

Business Conditions Satisfactory—Railroad Situation Not Serious—Porcelain Knobs in Good Demand

Business conditions throughout the Northwest are very satisfactory and a better tone prevails. Trade with Alaska during July was 50 per cent greater than for July last year.

Electrical jobbers and contractor-dealers report business very satisfactory. While the railroad strike has caused serious shortages in stocks in some cities of the Northwest, the situation in general has not been serious.

Collections are still poor. Prices show a strong upward trend. An increase of 12½ per cent in the price of conduit became effective during the past week. Seattle reports a serious shortage of conduit with a heavy demand.

Porcelain Knobs.—Tubes and cleats have been in good demand during the entire season. Knobs have advanced somewhat in price, and a further increase of from 20 to 30 per cent is predicted for the near future.

Salt Lake City–Denver

Transportation Conditions Better—Wire Market Holds Steady—Electric Ranges in Good Season

Transportation conditions are better than a week ago. The copper output is gradually increasing, the manufacture of radio equipment widening the market for this metal.

Wire.—The market holds steady, with a better call for bare than weatherproof. Much line extension and repairs account for the demand.

Electric Ranges.—Jobbers report a good season, with sales meeting expectations. Stocks are good and prices hold an even tone.

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Westinghouse Radio Apparatus Production Increasing

Owing to the expected heavy demand for radio sets for the coming Christmas trade, production at the Westinghouse Electric & Manufacturing Company's Springfield (Mass.) plant is steadily increasing. Receiving sets are now being turned out at the rate of 22,000 a month, with every prospect that an output of 35,000 a month will be attained by November. Eleven months ago the production was 400 a month.

Broadcasting now takes place from the Springfield station every night in the week, the Sunday evening program being a church service by a preacher and singers who go to the studio. The use of records for broadcasting has been almost entirely succeeded by personal talent. The company's new radio building is to be reinforced with an 8-in. brick wall on the inside throughout, which, it is said, will meet all building requirements. Additional space, however, will be required for this department in the near future.

Ohio Electric & Controller Makes Sales Appointments

The Ohio Electric & Controller Company Cleveland, announces the appointment of Paul H. Diver as manager of sales. Mr. Diver has been associated with this company four years as sales representative. The company also announces the appointment, effective

Sept. 1, of C. J. Pagel as sales representative. Mr. Pagel has been associated with the Robbins & Myers Company in the Cleveland district.

To Show Fuel-Saving Devices at Chemical Show

The managers of the Chemical Show, to be held in the Grand Central Palace, New York City, between Sept. 11 and 16, announced last week that the coal strike and the fuel shortage had given them the idea of expanding their display on fuel economy devices and that in the exposition would be devices suitable for both home and manufacturing plants.

"More efficient burning of fuel," said the announcement, "whether it be coal, coke, gas or oil and the cheaper generation of steam will be demonstrated in several new types of power-house equipment and also in improvements on systems now in use."

Electric Truck Parade to Be Feature of Exposition

Just how large a factor the electric truck has become in the transportation of merchandise about the city will be shown in the electric motor truck parade which is being arranged as one of the features of the annual Electrical and Industrial Exposition to be held at the Grand Central Palace, New York City, Oct. 7 to 14.

As in former years, electric trucks and passenger cars with their accessories will form one of the most important departments of the show. Every manufacturer in the Eastern market will be represented and the exhibits will range from 750-lb. delivery wagons to 5-ton trucks. The parade, however, is something new. There have been motor-truck parades in New York before, but never one made up exclusively of storage-battery vehicles.

The purpose of the parade is not so much to show the different styles of electric vehicles as it is to show what the electric truck is doing toward the solution of traffic problems in the city and the elimination of waste in delivery methods in the various fields of commerce. The local electric vehicle club has sent an invitation to every fleet owner in New York asking him to enter one or more of his cars, and several acceptances have been received. Entries will be grouped by industries, and accordingly there will be considerable competition as to which will make the best showing.

Westfield Company Suffers $100,000 Fire

The Westfield Machine Company, Westfield, Mass., sustained fire damages of about $100,000 on Aug. 15 to plant and stocks, which included a quantity of radio sets in production and ready to be marketed. The flames spread through the two stories of the factory, and considerable damage was done to a machine shop in the basement.

Wire Goods Companies in Million-Dollar Merger

The Wire Goods Company of Worcester, Mass., the Cassady-Fairbank Company of Chicago and the Andrews Wire & Iron Company of Rockford, Ill., and of Waterford, Canada, have been consolidated as a million-dollar corporation, with headquarters in Worcester. Eventually the business probably will be conducted under the name of the Washburn Company, the other corporation names disappearing.

The officers of the new corporation are: President, Charles G. Washburn; vice-presidents, Arthur G. Andrews, Rockford; Perry M. Shepard, Chicago, and William L. Walker; treasurer and general manager, Reginald Washburn; secretary, Irving A. Green; directors, Charles G. Washburn, Reginald Washburn, Arthur G. Andrews, Perry M. Shepard and William L. Walker.

The business of the Wire Goods Company was established in Worcester in 1880, and its growth has been large and steady ever since. In addition to the Cassady-Fairbank and the Andrews Company, the company has absorbed several other firms, including the Ayres Manufacturing Company, the E. Jenckes Manufacturing Company of Pawtucket, R. I., manufacturer of wire hardware, and the Woods-Sherwood Company of Lowell, the oldest concern in the country making kitchenware. The first factory was at what was then 2 Allen Court, now 12 Federal Street.

Lockwood, Greene & Company, Inc., Interests Move

Engineering, management and construction interests identified with Lockwood, Greene & Company, Inc., Boston, have removed their offices to 24 Federal Street in that city. Financial and all other activities of this house are now concentrated at the above address.

Allis-Chalmers Company Directors Meet

The board of directors of the Allis-Chalmers Company, at a monthly meeting held at the West Allis plant, Milwaukee, last week, declared a 1 per cent dividend on the common stock of record July 24, payable Aug. 15. They also elected George M. Moffett of New York, vice-president of the Corn Products Refining Company, a member of the board to fill the vacancy caused by the death of W. T. Abbott.

The directors, after looking over the plant and listening to statements by President Otto H. Falk and other officials, expressed themselves as well satisfied with conditions. It was stated that the June orders exceeded the month preceding by $2,470,000.

The feeling among the members of the board was decidedly optimistic. Each one predicted continued progress in prosperity throughout the country. With the present rail and coal strike settled, it was said, the country would move forward steadily toward a normal condition in business.

"The situation existing today is exactly what was forecast when we were here for the annual summer meeting of the board of directors last year," said Charles Hayden of Hayden, Stone & Company, New York, who is a member of the board.

Anaconda Copper Is Operating in Canada

The Anaconda Copper Mining Company has entered Canada through its subsidiary, the American Brass Company, and is operating Brown's Copper & Brass Rolling Mills Company at New Toronto.

The Anaconda American Brass, Ltd., has been formed, with the entire $1,000,000 capital stock owned by the American Brass Company. Charles F. Brooker is chairman of the board, John A. Coe president, G. H. Allen vice-president, C. F. Hollister treasurer, A. H. Quigley general manager, and M. S. Moss Secretary.

To Exhibit Cleveland Electrical Home in September

Preparations are being completed for the opening of the fourth and most complete Cleveland electrical home in the early part of September, according to an announcement by J. E. North, educational director of the Cleveland Electrical League.

A special committee of representative Cleveland electrical experts, headed by J. L. Wolf, secretary of the Lighting Fixture Dealers' Society, has been working on plans for the structure for more than six months.

The home will have ten rooms in addition to servants' quarters on the third floor, all fully equipped according to the very latest electrical labor-saving standards.

An electrical laundry with a number of new features and an electrical "dream" kitchen are included in the description.

The plans specify model lighting throughout the home with control switches at the bedside, making it possible to extinguish the ceiling lights after retiring.

A master switch in one bedroom will turn on all the principal lights in the home in case of an emergency.

The home will have a total of 186 electrical outlets, including those used for lighting purposes. This is more than four times the number of outlets installed in the average home, but is not too many according to Director North, who said, "Rather than attempt to overdo the matter of outlets we have tried to limit the number to those only absolutely essential.

"It will be the most complete electrical home we have yet been able to display in Cleveland," he added. "I believe it will be one of the best ever displayed in the country. We have spared no effort in getting the very best and the very latest of everything electrical included in the plans."

Wico Electric Company Plans New Home

The Wico Electric Company, Springfield, Mass., opened bids Aug. 24 for a new building in West Springfield, planned to be the first of five one-story units, each 400 ft. x 90 ft. in plan and of brick construction. The company reports a large increase since the beginning of the year in the production of motorcycle batteries and magnetos for small stationary engines. Next January it will have in production a new magneto for engines under 5 hp. Operations in the new building, which is to be ready January 1, will begin with 200 employees. The company expects to employ 400 in the near future. In addition to its old quarters on both sides of Taylor Street the company has rented the top floor of the American Electric Service & Maintenance Company's new building in the same street, to meet its requirements until the new building is ready.

Eastern Utah Electric Company to Have Larger Quarters

The Eastern Utah Electric Company, Price, Utah, will occupy new and much more commodious quarters in a building which is being erected on Main Street. The building will have two stories and a basement, and the electric company will occupy the basement and entire first floor. A unique lighting system and electric signs will make the building conspicuous.

With this additional room, augmented by a large warehouse on North Ninth Street, the electric company will greatly increase its various lines of electric goods and automobile accessories, and the new store will be divided into departments.

This company was organized three years ago and does a wholesale business over the whole of eastern Utah and western Colorado.

Federal Electric Announces Sales Personnel Changes

The following changes in the sales personnel of the Federal Electric Company, 8700 State Street, Chicago, have become effective, that company has announced.

John Berkhardt has been appointed manager of the Kansas City office. Mr. Berkhardt was previously with the estimating engineering department of the Commonwealth Edison Company for a period of more than twenty years.

R. D. Williams has been appointed manager of the Louisville (Ky.) office. His previous connection was with the Commonwealth Edison Company as assistant superintendent of construction of conduits for eleven yeears.

W. A. Keating, for fifteen years with the Duquesne Light Company, Pittsburgh, has been appointed manager of the Pittsburgh office.

E. W. Moore, previously Eastern European manager of the Ingersoll-Rand Company, has been appointed district manager of the Cincinnati office.

W. E. Brickman has been appointed traveling auditor for the Federal Electric Company, including its twenty-two branches all over the United States.

J. W. Sieverling, formerly with S. P. Bowser & Company, Inc., Fort Wayne, Ind., and Fulton A. Smith, Cleveland, has joined the Federal Electric Company as advertising manager.

Warns Against Worthless Radio Securities

The Better Business Bureau has made public a bulletin telling of the operation of companies hawking the securities of radio enterprises characterized by the bureau as "wildcat companies."

The bureau reports it has just made an investigation of a company whose sales organization is said to have already taken in many thousands of dollars. Like similar get-rich-quick concerns, the principals have taken care of themselves by voting heavily padded salaries for services, which consist mainly in selling stock, according to the bulletin.

Most of the sales are made among wage earners, the bulletin states, and the corporations, the investors are informed, are organized for the purpose of selling radio equipment to amateurs. But the only sales that are made, apparently, are of stocks, and if the stock selling ceases, the concern becomes insolvent, according to the bulletin.

The bulletin relates that one of these corporations recently advanced its stock from par ($1) to $1.50, an official of the company declaring that the boost was warranted as the company had been making big profits, 300 per cent being the average profit on the materials turned out. This profit was almost entirely on paper, but in spite of this it was declared that before winter came the stock would be worth $4.

"Not the least deceptive of the buncombe employed in the selling of the stock has been a radio-equipped motor car which has been driven about the streets of New York," the bulletin continues, pointing out that the car, which was used to create interest in radio in general and the company's securities in particular, was actually not equipped with apparatus of the company's own manufacture, as claims made in the literature circulated represented it to be.

The United Electric Construction Company, contracting electrical engineers, announces that its offices have been moved to 2318 Sansom Street, Philadelphia.

The Zeller Lacquer Manufacturing Company will exhibit at the coming Chemical Exposition in New York City a representative line of lacquers, lacquer enamels and bronzing solutions. Actual examples will show just how these materials are being used today for finishing economically products made from many kinds of materials.

The Hebern Electric Company, Inc., Newark, N. J., is completing plans for the construction of a new three-story reinforced-concrete building on Harrison Street, between Eighth and Ninth Streets, for the manufacture of electrical specialties, estimated to cost approximately $200,000. Bids will be called at an early date.

The Mercury Radio Products Company, 51 Thomas Street, Orange, N. J., has been incorporated with a capital of $100,000, to succeed the company of the same name heretofore operated as a partnership. Arrangements have been made for the removal of the plant to larger quarters at Little Falls, N. J., where production will be concentrated on complete radio sets and equipment. Myron S. Shields is president, Karl M. Jones vice-president, Bayard D. Brown secretary, and Edmund B. Osborne, Jr., treasurer, all of Montclair, N. J. Edgar Sisson, Jr., will act as radio engineer for the company.

The Dynamo & Motor Exchange, 41 Court Street, Buffalo, has leased a two-story building at 45 Elm Street, comprising about 7,000 sq.ft. of floor space, for expansion. A portion of the structure will be equipped as a shop for parts production and repair work, and the remainder of the structure will be used for the present as a warehouse.

The Spencer Electric Company, 320 Twelfth Street, Oakland, Cal., has purchased the stock and fixtures of the California Electrical Construction Company of that city.

The Apex Electrical Manufacturing Company, Cleveland, has acquired an additional factory site containing two acres of space. This will be devoted entirely to the manufacture of small electric motors and to the foundry department, officials of that company have announced. The company now owns two large factory units, and practically all of the material required for its cleaners, washers and ironers is manufactured in its own establishments.

The Electric Storage Battery Company, Philadelphia, has approved a pension plan for employees. A fund of $350,000 has been deposited. A male employee sixty-five years old who has been in the service of the company for thirty years is eligible for a pension. If his average earnings for ten years of highest pay were $2,000 per year, his pension would be thirty times 1½ per cent, or 45 per cent, of the average pay, or $900 a year.

The Potomac Electric Appliance Company, 607 Fourteenth Street, N. W., Washington, D. C., announces that J. S. Colt, formerly vice-president and general manager of the Wilmington Electric Appliance Company, has been appointed its general manager. Mr. Colt succeeds J. C. McLaughlin, recently resigned.

The Trenton Electric Supply Company, 207 East State Street, Trenton, N. J., has purchased property at 233 East State Street, 21 ft. x 150 ft., for future expansion. Charles F. McCoy is president.

Foreign Trade Notes

A NEW HYDRO-ELECTRIC SCHEME PROPOSED FOR VICTORIA, AUSTRALIA.—The Victorian Electricity Commission, the *Electrician* reports, has recommended to the government the adoption of a hydro-electric scheme to utilize the waters of the Sugar Loaf Reservoir and the Royston and Rubicon Rivers to supply electricity to the North-Eastern Couldbourne Valley and Melbourne areas, as an adjunct to the Morwell scheme. The cost is estimated at £5,000,000.

THE RAILWAY COMMISSIONERS MAY SUPPLY ADDITIONAL ELECTRICITY IN SYDNEY.—The General Purpose Committee of Sydney, New South Wales, Australia, the *Electrician* states, has decided to open negotiations for taking a bulk supply of electrical energy from the power plant of the Railway Commissioners under a five-year or ten-year contract. Forbes Mackay, engineer, has informed the Council that electricity can be generated at the plant of the Railway Commissioners at 0.6d. per unit compared with a cost of 0.7d. at the Council's plant. The committee has also agreed that Mr. Mackay shall have sole control of the management of the electricity department including the stores for that department.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN VENEZUELA.—The City Council of Carupao, the *Electrical Review* states, is considering the installation of a hydro-electric plant on the Guarenas River, about 18 miles from Caracas. The plant will have a capacity of about 2,500 hp. The project will include a 20-mile, 35,000-volt transmission line.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An engineer in Victoria, Australia (No. 3,221), wishes to purchase and secure an agency for all novelties, especially electrical articles.

An association in Italy (No. 3,252) desires to purchase and secure an agency for electrical batteries for telephones and other electrical installations, such as switches, alternators and circuit changers.

A commercial agent from the Dominican Republic (No. 3,163) is in the United States and desires to secure an agency for electrical machinery, hardware, etc.

ELECTRIC CRANES AND EXCAVATORS FOR PORT AT CONSTANTZA, RUMANIA.—M. Erbiceanu, Director-General du Port de Constantza, Rumania, the *Electrical Review* reports, is asking for tenders for six 3-ton electrically operated cranes and two excavators (continuous current at 440 volts supplied by the port authority).

TENDERS FOR EQUIPMENT FOR MORWELL (AUSTRALIA) POWER SCHEME. — Tenders will be received by R. Liddelow, secretary State Electricity Commission of Victoria, 22 William Street, Melbourne, Australia, until Nov. 4 for transformers, induction regulators and switchgear, as per specification No. 293. Copies of tender form and specification may be obtained upon application to the offices of the Bureau of Foreign and Domestic Commerce, Department of Commerce, First National Bank Building, Chicago, and 734 Customs House, New York City. Tenders may be inspected at the above offices and also at the office of the Commissioner for Australia in the United States at Room 3,012, 61 Broadway, New York City.

PROPOSED ELECTRIC PLANT FOR MARACAIBO, VENEZUELA, S. A. — Arrangements are being made by local capitalists to organize a company, to be known as the Planta Electrica del Zulia, according to *Commerce Reports*, to construct and operate an electric plant to supply electrical service in the city of Maracaibo. The company is to be capitalized at 600,000 bolivars ($115,800), for which subscriptions are now being taken. Names of persons interested in this company may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or through any of the district offices of the bureau, by referring to File No. 61,419.

ELECTRIC PLANT TO BE ESTABLISHED AT HANYANG, CHINA.—Steps have been taken, according to *Commerce Reports*, to build an electric light plant at Hanyang, Province of Hupeh, for which $150,000 is being raised.

EXTENSION OF DATE FOR RECEIVING TENDERS.—The time for receiving tenders for feed-water evaporators (Specification 227) for the Morwell power scheme by the State Electricity Commission of Victoria, Melbourne, Australia, the *Electrical Review* states, has been extended from Sept. 1 to Oct. 2.

New Apparatus and Publications

WELDING EQUIPMENT.—An engine-driven welding equipment for use where electric power for motor drive is not available has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

ELECTRIC SPACE HEATER.—An electric space heater that has many possible applications in industry, business and the home is manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

LIGHTING FIXTURES. — "Brascolite, the Ideal Light for Every Purpose" is the title of Catalog No. 9 issued by the Brascolite Company division of the St. Louis Brass Manufacturing Company, St. Louis, covering all of its various types of illuminating fixtures.

BUSHING.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is manufacturing a condenser type of bushing, designed for high-voltage service.

TRANSFORMER.—An oil immersed, self-cooling transformer which requires no auxiliary equipment is manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

VENTILATING FANS. — The Autovent Fan & Blower Company, 730 West Monroe Street, Chicago, is distributing bulletin 56, covering its new "Autovent" window ventilator.

HYDRAULIC PLATE PRESSES. — The Hydraulic Press Manufacturing Company, Mount Gilead, Ohio, is distributing two bulletins, one describing and illustrating its "H-P-M" hydraulic hot and cold plate presses for molding bakelite, condensite and other compositions, the other describing its operating system for the "H-P-M" hydraulic plastic molding presses.

NEW FINISH FOR FLUSH PLATES.—The Cutler-Hammer Manufacturing Company, Milwaukee, has developed a new finish for flush plates, known as "Brush Lac."

GOVERNOR FOR IMPULSE TURBINES.—The English Electric Company, Ltd., Queen's House, Kingsway, London, W. C. 2, has issued publication No. 365 describing and illustrating the "Seewer" governing device for impulse turbine.

GAGES.—The Foxboro Company, Inc., Foxboro, Mass., is distributing a leaflet covering the "Foxboro" triplex and duplex draft gages.

ROLLING CONTACTS FOR CONTROLLERS.—The advantages of rolling contacts for control apparatus are described in leaflet No. 3,428 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

New Incorporations

THE HARLO MANUFACTURING COMPANY, INC., New York County, has been incorporated by M. Harris, 451 Greenwich Street, New York City. The company is capitalized at $250,000 and proposes to manufacture electric appliances and specialties.

THE STODDER WAVE POWER CORPORATION, New Rochelle, N. Y., has been incorporated with a capital stock of $25,000 by E. D. Stodder, D. J. MacLean and G. L. Gleason. Tierney, Schrenkeisen & Kettner, New Rochelle, are attorneys.

THE METROPOLITAN ELECTRIC SIGN COMPANY, 4,250 Northwestern Avenue, Chicago, has been incorporated by Maurice M. Talmadge, Samuel O. Simons, William Kramer, Walter Elsner and Ray C. Pratt. The company is capitalized at $40,000 and proposes to manufacture and deal in electrical signs.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MEDWAY, ME.—The Public Utilities Commission has granted the Penobscot Power Company permission to issue $300,000 in capital stock and $600,000 in bonds, the proceeds to be used for the purchase of water privileges at Rockabem's Rips on the Penobscot River in the town of Medway, and to build a hydro-electric plant at that point and a transmission line to Howland and Enfield.

SUNAPEE, N. H.—Preparations are being made by the Sunapee Electric & Power Company for the erection of a new power house.

SWANTON, VT. — Arrangements have been made for the installation of a new 1,250-kva. Westinghouse generating unit directly connected to an S. Morgan Smith turbine to be installed in the municipal generating station on the Missisquoi River, at Highgate Falls. The cost is estimated at about $30,000. J. R. Tozer is superintendent.

NORTHAMPTON, MASS.—Bids will be received at the office of the quartermaster general, Room 2306 Munitions Building, Washington, D. C., until Sept. 12 for construction of a group of twenty-four hospital buildings at Northampton, including sewer, water and lighting systems.

PROVIDENCE, R. I.—Work will begin at once on the construction of a one-story power house at the Butler Hospital.

ANSONIA, CONN.—The S. O. & C. Company will begin the erection of a one-story power house, 30 ft. x 50 ft., at its local brass works.

WALLINGFORD, CONN.—The Borough Council has contracted with the Connecticut Light & Power Company for the purchase of electricity, to be distributed by the municipal system. Work will soon begin on the erection of a transmission line from Cheshire to Wallingford to supply the service.

WILLIMANTIC, CONN.—The Quidnick-Windham Manufacturing Company will make improvements to its hydro-electric power plant, increasing the capacity to 300 hp. New equipment, including a water-wheel, will be installed.

North Atlantic States

ANGELICA, N. Y.—Bonds to the amount of $20,000 have been voted for the installation of a municipal electric light plant. The village will build and operate the distributing system and purchase energy from the Genesee Valley Electric Company, connection to be made at Transit Bridge, 3 miles from here.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has purchased the Rockbottom Dam, which it proposes to enlarge for the purpose of furnishing power to industrial plants in Binghamton.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 29, for 87,000 ft. of lamp cord for use at the Brooklyn Navy Yard. (Schedule No. 110.)

COHOES, N. Y.—Bids will be received by Charles L. Cadle, Superintendent of Public Works, Capitol, Albany, until Sept. 6 for construction of the Crescent power house and work incidental thereto at Cohoes (A-3).

DANNEMORA, N. Y.—Work will soon begin on the construction of a new power house at the Clinton prison in Dannemora. Charles F. Rattigan, Superintendent of State Prisons, Albany, is in charge.

FREEPORT, N. Y.—The installation of an ornamental lighting system, to cost about $26,360, is under consideration.

LYNBROOK, N. Y.—The Queensboro Gas & Electric Company, Far Rockaway, will begin work at once construction of a two-story sub-station, 33 ft. x 37 ft., in Lynbrook.

NEW YORK, N. Y.—Bids will be re-

ceived by C. B. J. Snyder, superintendent of school buildings, until Aug. 30 for installing electric wiring and fittings in the new Public School 80 on East Eightieth Street, near First Avenue, borough of Manhattan. Bids will also be received until Aug. 28 for alteration and additions to the electric lighting equipment in Public Schools 7, 21, 29, 65, 110, 188 and West Side Continuation School, borough of Manhattan.

OSWEGO, N. Y.—The question of establishing a municipal electric light plant is under consideration by the Water Service Commission.

POUGHKEEPSIE, N. Y.—A petition will be presented to the Board of Aldermen by the residents of the Seventh Ward asking for an extension of the ornamental lighting system from Cherry Street to the city line.

CHATHAM, N. J.—The Commonwealth Electric Company, Summit, is negotiating with the Borough Councils of Chatham and Madison to furnish light and power service. It is proposed to close down the local municipal generating plant.

MADISON, N. J.—Bids will be received by Tribus & Massa, 15 Park Row, New York City, until Aug. 30, for artesian-well connections, pumping plant and electric equipment for the estate of H. McK. Twombly near Madison.

NEWARK, N. J.—The Public Service Electric Company has authorized plans prepared for the proposed addition to its Essex power station, Point-No-Point, to cost about $4,000,000.

BATH, PA.—Bonds to the amount of $5,600 have been authorized for the installation of a street-lighting system. The borough already has a residential lighting service.

EAST GREENVILLE, PA.—The Boyertown Burial Casket Works contemplates installing an electric plant.

HANOVER, PA.—Preparations are being made to erect an addition to the power station of the Hanover Light, Heat & Power Company in the West End. A new switch and coal elevator and two new boilers will be installed. Surveys are being made for a new transmission line from New Oxford to Gettysburg.

KINGSTON, PA.—The Luzerne County Gas & Electric Company will extend its transmission system to West Wyoming, Mocanaqua, Shickshinny and vicinity, to cost about $200,000.

MOUNT HOLLY SPRINGS, PA. — The Cumberland Valley Light & Power Company has applied to the Public Service Commission to acquire and merge thirteen electric companies, operating in York and Adams Counties. Extensions and improvements will be made.

NORRISTOWN, PA.—The Town Council has decided to accept the proposal of the Counties Gas & Electric Company to supply electricity to operate the municipal electric light plant. The municipal generating plant will be closed down in November.

OIL CITY, PA.—The installation of an ornamental lighting system in the business section is under consideration, and plans have been submitted by V. A. Redfield, superintendent of the Citizens' Light & Power Company.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company has issued $2,150,000 in bonds, part of the proceeds to be used for extensions and improvements in electric stations and system.

POTTSVILLE, PA. — The East Penn Electric Company has secured permission from the Public Service Commission to merge fourteen electric companies operating in Schuylkill County. Extensions and improvements will be made.

READING, PA.—The West Reading power plant of the Metropolitan Edison Company was recently damaged by an explosion, causing a loss of about $10,000.

FAIRMONT, W. Va.—The Fairmont-Chicago Coal Company, recently incorporated, plans to install electrical equipment at its local mine.

WASHINGTON, D. C.—Bids will be received by the office of the public printer, Government Printing Office, until Aug. 31 for two motor-driven air compressors and one general service pump.

WASHINGTON, D. C.—Extensions and improvements to the Armstrong Manual Training School are under consideration by the District Commissioners, for which $500,000 has been appropriated. Further information may be obtained by addressing chief clerk, care Engineering Department, 427 District Building.

WASHINGTON, D. C.—Bids will be received by A. L. Flint, general purchasing officer, Panama Canal, until Aug. 31, for five variable condensers, 10 lb. resistance wire, 147 lb. magnet wire, 2,500 ft. lamp cord, twenty rotary-type switches, sixty rotary snap switches and 100 cut-outs. (Circular 2298.) Also, until Aug. 29, one power-factor meter, two tachometers, four arc controls, six storage batteries and 300 cartridge fuses. (Circular 2297.)

North Central States

ANN ARBOR, MICH.—The Detroit Edison Company has awarded a general contract to the Wolverine Engineering & Construction Company, Penobscot Building, Detroit, for the construction of an addition to its power plant on the Huron River, to cost about $50,000.

DETROIT, MICH.—The Board of Fire Commissioners are considering the installation of 5,000 ft. two-duct, 8,500 ft. three-duct and 12,000 ft. four-duct conduit and seventy manholes. L. Gascoigne is superintendent.

LANSING, MICH.—A special election will be called to vote on the proposal to issue $135,000 in bonds for extensions and improvements to the municipal electric system and waterworks.

ADA, OHIO—Work will soon commence on the construction of a one-story power plant for Ohio Northern University, to cost about $90,000.

COLUMBUS, OHIO—The H. C. Godman Company, 35 North Fourth Street, will begin work at once for the construction of a power plant at its factory, to cost about $50,000.

OAK HARBOR, OHIO.—The Northwestern Ohio Railway & Power Company will erect a transmission line from Clay Center to Milbury, a distance of about 4½ miles, and will install a distributing system at the latter place. A 2,200-volt transmission line also will be built from Curtice to Williston.

HOPE, IND.—The Chamber of Commerce is negotiating with the Interstate Public Service Company, Indianapolis, for the installation of a street-lighting system with ornamental lamps in the business section. The company will extend its transmission line from Edinburg.

INDIANAPOLIS, IND. — The Indianapolis Street Railway Company contemplates extensions to its power house and electrical system. New substations will be erected.

PERU, IND.—The municipal Electric Light Department has petitioned the Public Service Commission for authority to furnish electricity from the municipal electric light plant to consumers outside of the city limits.

EDWARDSVILLE, ILL.—The installation of an ornamental lighting system in the business district is under consideration. Street-lighting service is supplied by the Madison County Light & Power Company.

HILLSBORO, ILL.—The Illinois Commerce Commission has granted the Southern Illinois Light & Power Company permission to acquire the Tilden (Ill..) light and power plant and to extend its service from Belleville to Coulterville and from Pinckneyville to Winkle. The company was authorized to pay $9,750 for the Tilden property and to erect 33,000-volt transmission lines for the other extensions.

LA SALLE, ILL.—The Illinois Traction Company, Peoria, is preparing plans for an addition to its local substation, to cost about $45,000.

SIBLEY, ILL.—Bids will be received by the village of Sibley until Aug. 8 for a new storage battery and switchboard for the municipal electric plant. S. M. Waldon is village treasurer.

BARABOO, WIS.—Plans are being prepared by C. N. Ward, consulting engineer, for extensions and improvements to the hydro-electric plant of the Baraboo Linen Mills, owned by George S. McArthur & Sons. New equipment, including waterwheels and generators, will be installed.

IRON RIVER, WIS.—The North Wisconsin Hydro Electric Power Company, Port Wing, is reported to be negotiating for the purchase of the plant of the Iron River Light & Power Company.

POUND, WIS.—Plans are being prepared by the Wisconsin Public Service Company, Green Bay, for the erection of a high-tension transmission line from Pound to Menominee, Mich., a distance of 20 miles. Mead & Seastone, State Journal Block, Madison, are engineers.

DULUTH, MINN.—The McDougall Terminal Warehouse Company will build a power plant in connection with its new local freight terminal, to cost $1,750,000. An ice-manufacturing and refrigerating plant will also be built. A. Miller McDougall is president.

ST. LOUIS, MO.—The Public Service Commission has given its approval to the reorganization and refinancing plan of the Union Electric Light & Power Company, under which the company will begin immediately on plans for expansion and improvements involving an expenditure of $90,000,000. One of the projects contemplated by the new company is the construction of a steam-driven power plant near the municipal bridge, to cost approximately $25,000,000. The entire output will be taken by the Union Electric Light & Power Company. Louis H. Egan is president of the new company.

SPRINGFIELD, MO.—The power plant and ice factory at the Stockton Roller Mills, recently destroyed by fire, it is understood, will be rebuilt. The loss is estimated at about $50,000.

KENNEBEC, S. D.—The power house of the Kennebec Electric Light Company was recently destroyed by fire. The town at present is without electric service.

ALVO, NEB.—Contract has been let to the M. B. Messler Electric Company, Chillicothe, Mo., for the construction of a transmission line and distributing system.

McCOOK, NEB.—The Chicago, Burlington & Quincy Railroad Company, Chicago, will erect a power plant in McCook to cost about $85,000.

OAKLAND, NEB.—Work will soon commence on extensions to the electric lighting system. The Rohrbaugh Engineering Company, City National Bank Building, Omaha, is engineer.

COLONY, KAN.—The Council has rejected bids and abandoned plans for proposed extensions and improvements to the municipal power plant. A transmission line for central-station service will be constructed instead. Plans are being prepared by Black & Veatch, 701 Mutual Building, Kansas City, Mo., engineers.

Southern States

CLIFFSIDE, N. C.—The Southern Power Company, Charlotte, has started work on the erection of a transmission line from the Shelby substation to Caroleen, Henryetta and Cliffside.

DURHAM, N. C.—The Durham Traction Company contemplates extending its electric service to a new subdivision southwest of the city.

LENOIR, N. C.—A. M. Kistler, Morgantown, who recently purchased the property of the Citizens' Light & Power Company, is interested in a project to erect a transmission line from the transmission system of the Southern Power Company at Hickory to Lenoir, to supply electricity to industrial plants.

MAYSVILLE, S. C.—Bids will be received at the office of the Commissioners of Public Works until Aug. 31 for the erection of a 13,200-volt or 6,600-volt transmission line, a 2,300-volt distribution system and two substations. The Ryan Engineering Company, Columbia, is engineer.

ATLANTA, GA.—The White Provision Company will build an addition to its power house. A five-story ice and cold-storage plant will also be erected.

ATLANTA, GA.—The Collins Development Company, 64 Peachtree Street, contemplates the installation of an electric lighting system in a new housing development, comprising 144 acres of land, near the city limits.

ORLANDO, FLA.—Bids will be received by the Utilities Commission of the city of Orlando until Aug. 30 for construction of power station and equipment. Alvord, Burdick & Howson are consulting engineers.

TAMPA, FLA.—The Tampa Electric Company contemplates extending its transmission lines to other parts of the county to supply electrical service.

TAMPA, FLA.—Arrangements are being made to erect a transmission line from Tampa to Plant City (22 miles) to furnish electricity to the Plant City Public Service Company. The company will also supply electricity in the towns of Sefner, Lake Thonotosassa, Valrico and Dover.

NASHVILLE, TENN.—The Tennessee Electric Power Company has issued $3,000,000 in bonds, part of the proceeds to be used for extensions and improvements. The company is a merger of the Tennessee Power Company, Chattanooga Railway & Light Company and Chattanooga & Tennessee River Power Company.

ROGERS, ARK.—Work has begun on the erection of the high-tension transmission line of the Fayetteville (Ark.) Gas & Electric Company from Springdale to Rogers. When completed the generating plant of the Rogers Light & Water Company will be closed down.

WALNUT RIDGE, ARK.—The Central Power & Light Company will make extensions and improvements to its system, including the installation of new equipment.

BASTROP, LA.—Extensions and improvements are contemplated to the municipal electric lighting system and waterworks, for which $45,000 in bonds have been voted.

SHREVEPORT, LA.—Bonds to the amount of $4,000,000 have been voted for a new courthouse, jail, storm sewers, pavements and firealarm system.

BARNESDALL, OKLA.—The Council has awarded a contract to the Bigheart (Okla.) Light & Power Company for the installation of fifty street lamps.

GLENPOOL, OKLA.—The Central Oklahoma Light & Power Company has applied to the council for a twenty-five-year franchise to supply electricity in Glenpool.

HOUSTON, TEX.—The Council will install a street-lighting system on Fannin Street from Congress Street to McKinney Avenue.

Pacific and Mountain States

CHEHALIS, WASH.—The Council has rejected bids, recently received, for the installation of a lighting system and will handle the work through the engineering department.

OLYMPIA, WASH.—The Westside Rural Light & Power Company, recently organized, plans to install a power plant and system for service in towns near Olympia. L. E. Duval is head.

ROSEBURG, ORE.—The City Council has authorized the city attorney to take steps toward condemning the city electric lighting system. Connecting the city with the high-tension transmission line of the California-Oregon Power Company is also under consideration.

BURLINGAME, CAL.—The Council contemplates the installation of ornamental lamps on several streets in the city.

FRESNO, CAL.—Plans have been prepared for an irrigation project for the Mendota Irrigation District, to cost about $33,140,000. The project will include a power plant on the Kings River at Piedra, to cost about $1,200,000, a diversion dam at Fresno slough and a system of large pumping plants between Fresno slough and Kerman. I. Teilman, Fresno, is engineer.

INGLEWOOD, CAL. — The Southern California Edison Company, Los Angeles, is preparing plans for the construction of a 7,000-hp. substation in Inglewood, to cost about $60,000.

SATICOY, CAL.—Surveys are being made by the Southern California Edison Company for the erection of a transmission line from Saticoy to Santa Barbara County.

WEED, CAL.—Work has begun on the construction of a new power house for the Weed Lumber Company. Waste and sawdust from the factory will be used for fuel. The company at present purchases power from the California-Oregon Power Company.

GREAT FALLS, MONT.—Tentative plans are under consideration by the Anaconda Copper Mining Company, 25 Broadway, New York City, for building a brass fabricating plant in connection with its local works, to cost about $500,000.

Canada

ST. JOHN, N. B.—A proposal offering to sell the property and holdings of the New Brunswick Power Company to the city has been submitted to the City Council.

NEW GLASGOW, N. S.—The Pictou Power Company is considering the construction of a power plant on the East River of Sheet Harbor.

LAKEFIELD, ONT.—The Canada Cement Company contemplates the installation of a 2,000 hp. electric power plant.

MONTREAL, QUE.—Plans are under way by the Bell Telephone Company of Canada for extensive improvements, involving an expenditure of about $25,000,000 during the next five years. About $12,000,000 will be expended in Toronto during that period.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 8, 1922)

1,425,079. ELECTRIC PERFORATING APPLIANCE; Ralph R. Cone, Syracuse, N. Y. App. filed March 24, 1919. Punctures paper electrically when writing.

1,425,091. POLYPHASE TRANSFORMER; Samuel Horelick, Pittsburgh, Pa. App. filed May 28, 1921. Core construction with oval windings.

1,425,123. IMPULSE TRANSMITTER; Ray H. Manson, Rochester, N. Y. App. filed Aug. 26, 1919. For controlling directively operated automatic switches.

1,425,154. APPARATUS FOR RECEIVING RADIO-SIGNALS; Roy A. Weagant, New York, N. Y. App. filed Dec. 13, 1917. Open-ended inverted trough-shaped screen protects antenna from disturbances.

1,425,163. ELECTRIC STORAGE BATTERY; Hans Bardt, Santiago, Chile. App. filed Sept. 17, 1921. Electrolyte of perchlorate solution, negative electrode of ferro-silicon alloy and positive electrode with coating of lead oxide.

1,425,170. STEERING-COLUMN CONTROL UNIT; Stephen F. Briggs and Edward N. Jacobi, Milwaukee, Wis. App. filed Sept. 30, 1916. All controlling devices usually on dash placed in terminal head on steering column.

1,425,180. MECHANICAL MOVEMENT; Victor R. Despard, Hinsdale, Ill. App. filed Jan. 2, 1917. For lamp-socket switch.

1,425,183. TRANSMITTER; Thomas A. Edison, Llewellyn Park, West Orange, N. J. App. filed Oct. 26, 1918. Microphone transmitter supported by resilient material to eliminated jars, etc.

1,425,184. PRODUCTION OF THIN METAL SHEETS OR FOILS; Thomas A. Edison, Llewellyn Park, West Orange, N. J. App. filed Aug. 26, 1920. Electrolytically deposited on electrode belt from which it is stripped.

1,425,229. MOVABLE ELEMENT FOR METERS; Donald J. Angus, Indianapolis, Ind. App. filed May 20, 1918. Construction and mounting of element and of marking device.

1,425,235. MAGNETIC SEPARATOR; Walter E. F. Bradley, New York, N. Y. App. filed Sept. 21, 1918. For classifying or concentrating magnetic and non-magnetic filings.

1,425,344. ELECTRIC TOASTER; Edward Schwartz, New York, N. Y. App. filed June 30, 1918. Three elements between which rack holding bread is slipped.

1,425,375. CONTROLLING DEVICE FOR ELECTRIC MINING LOCOMOTIVES; Sidney W. Farnham, Chicago, Ill. App. filed Jan. 22, 1916. Connects motor either to trolley or gathering reel.

1,425,382. SQUEEZE CONNECTOR; George L. Hatheway, New York, N. Y. App filed Oct. 3, 1921. For making connection to pipes, etc.

1,425,440. ELECTRODE HOLDER; William C. Beiswinger and Robert F. Morgan, Wilkes-Barre, Pa. App. filed Dec. 27, 1921. Clamp for holding welding electrode has insulated head to protect operator when changing length of rod.

1,425,462. PILOT SIGNAL FOR ELECTRIC HEATING DEVICES; Ray F. Farrell and Claude E. Moon, Oxnard, Cal. App. filed Oct. 16, 1920. Lamp fed from small transformer on electric iron.

1,425,469. ELECTRIC STORAGE BATTERY; Walter L. Gill, San Bernardino, Cal. App. filed Sept. 30, 1920. Separators in inverted-U shape around edges of electrodes.

(Issued Aug. 15, 1922).

1,425,522. SYSTEM FOR SOUND TRANSMISSION; John H. Hammond, Jr., Gloucester, Mass. App. filed June 7, 1917. Multiple sound transmission system controlled in response to electro-radiant energy.

1,425,523. TRANSMISSION SYSTEM FOR RADIANT ENERGY; John H. Hammond, Jr. Gloucester, Mass. App. filed June 22, 1917. System for transmission of radiant energy with central control station and one or more auxiliary control stations associated therewith.

1,425,572. ZIRCONIUM ALLOY AND PROCESS OF MAKING SAME; Frederick M. Becket, Niagara Falls, N. Y. App. filed Oct. 1, 1920. Consists of iron, silicon and zirconium smelted in electric furnace.

1,425,573. ELECTRIC BATTERY; Raymond C. Benner and Harry F. French, Fremont, Ohio. App. filed Jan. 16, 1919. Dry battery with negative electrode of zinc and lead.

1,425,583. STREET INDICATOR FOR STREET-RAILWAY SYSTEMS; Alfred M. Gallery, Toronto, Canada. App. filed March 23, 1922. Operated by motor and under control of conductor.

1,425,606. ELECTRIC LIGHT BULB; Cleveland H. Quackenbush and Harvey E. Quackenbush, Cleveland, Ohio. App. filed April 6, 1921. Manufacture of miniature bulbs.

1,425,615. SYSTEM OF SHIP PROPULSION; Wilfred Sykes, Wilkinsburg, Pa. App. filed May 23, 1919. Generators driven by internal-combustion engines employed for energizing propeller motors.

1,425,632. COMMUTATOR BRUSH; William S. Click, Turtle Creek, Pa. App. filed Oct. 29, 1920. Pigtail screwed into brush.

1,425,633. SOLDERING POT AND SOLDERING IRON; Ora A. Colby, Irwin, Pa. App. filed Dec. 10, 1919. Electrically heated pot with clamp for holding iron in solder.

1,425,638. SCREW-SOCKET CONNECTION FOR RADIATORS; Frank F. Forshee, Flint, Mich. App. filed Nov. 20, 1919. Parabolic electric heater.

1,425,639. CENTRIFUGALLY ACTUATED SHORT-CIRCUITING DEVICE; George H. Garcelon, Swissvale, and Joseph L. Chantemerle, Turtle Creek, Pa. App. filed May 3, 1916. For bringing single-phase commutator induction motors up to speed.

1,425,640. MOTOR-CONTROL SYSTEM; Adolph A. Gazda, Wilkinsburg, Pa. App. filed Jan. 29, 1917. Automatic accelerating of polyphase induction motors with resistors in wound-rotor circuits.

1,425,646. CONTROL SYSTEM; Albert L. Harvey, Wilkinsburg, Pa. App. filed May 12, 1919. System for controlling field excitation of shunt and compound-wound direct-current motors.

1,425,647. CONTROL SYSTEM; Albert L. Harvey, Wilkinsburg, Pa. App. filed May 15, 1919. System for controlling direct-current motors provided with dynamic braking.

1,425,648. MOTOR-CONTROL SYSTEM; Albert L. Harvey, Wilkinsburg, Pa. App. filed Nov. 3, 1919. Employed with auxiliary motors on machine tools.

1,425,652. SYSTEM OF SPEED CONTROL FOR INDUCTION MACHINES; Rudolf E. Hellmund, Swissvale, Pa. App. filed Aug. 10, 1918. Permits operation at several speeds with high efficiency.

1,425,657. MOTOR-CONTROL SYSTEM; Henry D. James, Edgewood Park, Pa. App. filed Nov. 5, 1920. For motors employed to operate skip hoists.

1,425,662. MOTOR-CONTROL SYSTEM; Harold L. Keith, Wilkinsburg, Pa. App. filed Nov. 24, 1919. Employed in connection with the auxiliary motors on machine tools.

1,425,665. MAXIMUM-DEMAND METER; Paul M. Lincoln, Pittsburgh, Pa. App. filed July 10, 1918. Thermal type provided with compensating means for radiated heat.

1,425,685. INCLOSED TOASTER; Wilbur Pascoe, Detroit, Mich. App. filed Sept. 11, 1920. Metal casing with windows of mica.

1,425,689. CHARGING RACK; Raymond E. Powell, Chicago, Ill. App. filed Oct. 1, 1920. Apparatus for charging small batteries from commercial direct-current circuits.

1,425,694. ELECTRICAL ATTACHMENT PLUG; Adolph C. Recker, Oakville, Conn. App. filed Aug. 26, 1919. For heating or lighting appliances.

1,425,721. BATTERY CONTAINER; Roy W. Taylor, Chicago, Ill. App. filed Oct. 25, 1920. Relates to combinations, construction and arrangements of containers.

1,425,728. TELEPHONE-EXCHANGE SYSTEM; Harry G. Webster, Chicago, Ill. App. filed March 9, 1908. Selective switches employed in building up connections from calling subscribers' lines to the called subscribers' lines.

1,425,743. APPARATUS FOR PRODUCING THERAPEUTICAL EFFECTS; Sydney N. Baruch, San Francisco, Cal. App. filed May 14, 1919. Produces dielectric or electrostatic hysteresis within body.

1,425,752. ELECTROLYTIC CELL; Alfred V. Davis, Elkton, Md. App. filed June 7, 1921. Cell in which electrolyte is maintained at practically a point of saturation.